

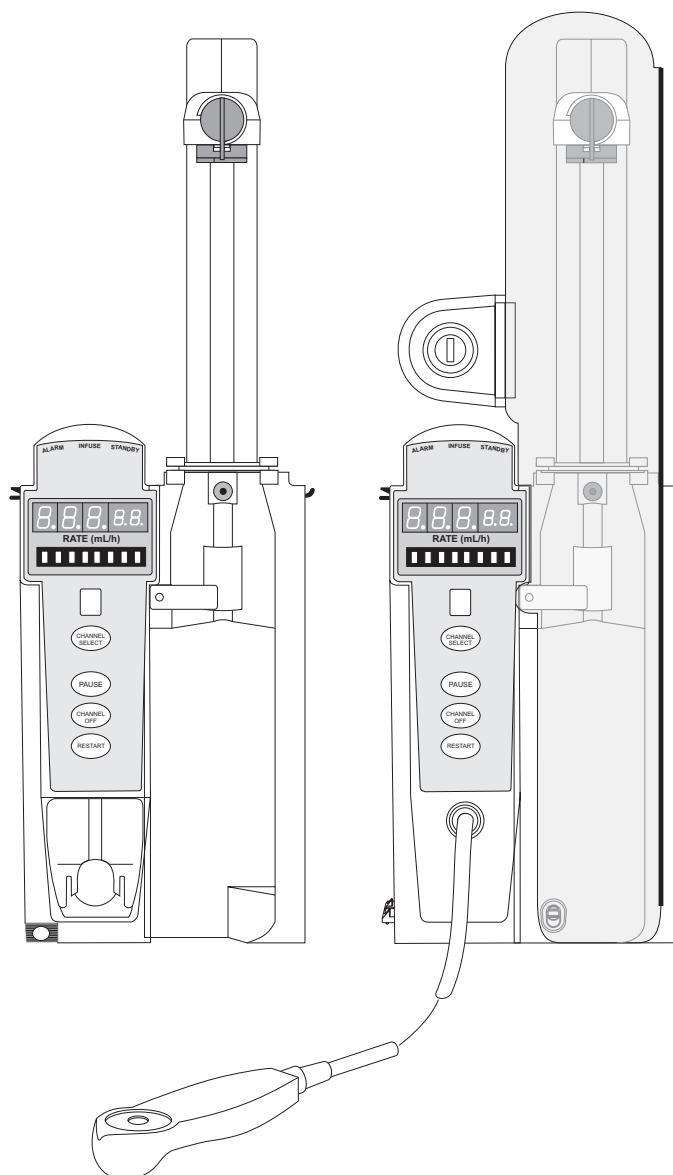
# Technical Service Manual

Alaris® Syringe Module, 8110 Series

Alaris® PCA Module, 8120 Series

Supports: Guardrails® Suite (v7 or later)

January 2006



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# Chapter 1 — GENERAL INFORMATION

## CAUTION

To avoid damaging the keypad, do not use sharp objects (pens, pencils, etc.) to activate switches.

## CAUTION

Any attempt to service this product by anyone other than an authorized Cardinal Health Service Representative while the product is under warranty may invalidate the warranty.

## 1.1 INTRODUCTION

This manual describes how to service the Alaris® Syringe Module (“Syringe Module”, 8110 Series) and Alaris® PCA Module (“PCA Module”, 8120 Series). Use this manual in conjunction with the following Alaris® System documents and software:

- Alaris® Point-of-Care unit (“PC Unit”, 8000 Series) / Alaris® Pump Module (“Pump Module”, 8100 Series) Technical Service Manual
- Alaris® System Directions for Use (DFU)
- Maintenance Software and User Manual (Software v7.x or later)

**PRODUCT NAME NOTE:** The “Alaris® System” was formerly known as the “Medley™ System” and is described in the Alaris® System DFU.

This manual is intended for personnel experienced in analysis, troubleshooting, and repair of analog/digital microprocessor-based electronic equipment.

If either module requires service while under warranty, it must be serviced only by Cardinal Health authorized service personnel. Refer to the “Warranty” and “Service Information” sections of the Alaris® System DFU.

The Alaris® System is a modular infusion and monitoring system intended for use in adult, pediatric and neonatal healthcare.

The Syringe Module is intended for facilities that use syringe pumps to deliver fluids, medications, blood, and blood products using continuous or intermittent delivery through clinically acceptable routes of administration, such as intravenous (IV), intra-arterial (IA), subcutaneous, epidural, enteral, or irrigation of fluid spaces.

### 1.1 INTRODUCTION (Continued)

The PCA Module is intended for facilities that use syringe pumps to deliver fluids or medications using continuous or intermittent delivery through clinically acceptable routes of administration, such as intravenous (IV), subcutaneous, or epidural.

Refer to the product-specific (Syringe Module or PCA Module) section of the Alaris® System DFU for a list of features and detailed information regarding setup and operation.

### 1.2 PRECAUTION DEFINITIONS

Refer to the Alaris® System DFU .

### 1.3 SPECIFICATIONS

Refer to the product-specific section of the Alaris® System DFU.

### 1.4 OPERATING FEATURES, CONTROLS AND INDICATORS

Refer to the product-specific section of the Alaris® System DFU.

### 1.5 ACCESSORIES

The Syringe Module uses standard, single-use, disposable syringes (with luer-lock connectors) and administration sets designed for use on syringe pumps.

The PCA Module uses standard or pre-filled, single-use disposable syringes (with luer-lock connectors) and non-dedicated administration sets with integrated anti-siphon valves designed for use on syringe-type PCA devices. For specific administration set instructions, reference the directions for use provided with the set.

### WARNING

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Use only specified syringes and administration sets with the Syringe and PCA Modules. Using other syringes or administration sets can cause improper instrument operation, inaccurate fluid delivery or pressure sensing, or other potential hazards. For a list of compatible syringes, refer to the product-specific section of the Alaris® System DFU. For a list of compatible administration sets, refer to the module's Administration Set Compatibility Card/Insert (provided separately).

### 1.6 ALARMS, ERRORS, MESSAGES

Alarm messages are displayed on the scrolling Message Display bar. Refer to the product-specific section of the Alaris® System DFU for detailed information.

#### 1.6.1 Silencing Alarms

All alarms can be temporarily silenced by pressing the **SILENCE** key on the PC Unit.

### WARNING

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If an alarm condition on the module occurs while the audio alarm is silenced, the only alarm indications will be visual displays and symbols related to the alarm condition.

### 1.7 TRUMPET AND START-UP CURVES

Refer to the product-specific section of the Alaris® System DFU.

**Table 1-1. Abbreviations, Acronyms**

Various abbreviations and acronyms are used throughout this manual. The following are those that are not commonly known or easily recognized.

CHSE HD	cheese head (screw)
DB0	database zero
DFU	Directions for Use
IA	intra-arterial
IUI	inter-unit interface
NEOI	near end of infusion
TR HD	truss head (screw)
VDAC	voltage DAC

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## 2 CHECKOUT & CONFIGURATION





## Chapter 2 — CHECKOUT AND CONFIGURATION

### CAUTION

Should an instrument be jarred severely or dropped, remove it from use immediately. It should be thoroughly tested and inspected by qualified service personnel to ensure proper function prior to reuse.

### 2.1 INTRODUCTION

This chapter describes initial setup and configuration for the Syringe and PCA Modules.

**NOTE:** Due to product changes over time, configurations described in this chapter may differ from the instrument under service. If there are any questions, contact Cardinal Health Technical Support.

### 2.2 NEW INSTRUMENT CHECKOUT

Prior to placing a new instrument in use, perform a check-in procedure using the Maintenance Software.

When powering up the instrument, verify the instrument beeps and all display LED segments flash. This confirms that the instrument has performed its self test and is operating correctly. During operation, the instrument continually performs a self test, and will alarm and display a message if it detects an internal malfunction.

Contact Cardinal Health authorized service personnel if the instrument has physical damage, fails to satisfactorily pass the startup sequence, fails a self test, or continues to alarm.

### 2.3 CONFIGURATION OPTIONS AND DEFAULTS - SYRINGE MODULE

#### NOTES:

- Changes to the factory default values are retained after a power cycle.
- If **Factory Default** is **Yes**, then all the configuration settings are set to their factory default.
- If **Factory Default** is **No**, then one or more of the configuration settings has been changed. Setting **Factory Default** to **Yes** sets all configuration settings to their factory default.
- With the Profiles feature enabled, the settings are configured independently for each profile. A hospital-defined, best-practice data set must be uploaded to enable the Profiles feature. Date and Time is a system setting and is the same in all profiles.

Refer to the Alaris® System DFU for the following:

- System Settings
- Shared Infusion Settings (Pump Module and Syringe Module)
- Syringe Module Settings

#### 2.3.1 Factory Default Setting

To allow changes to System Configuration parameters:

1. Hold **OPTIONS** key at power up.

System Config - Module 1 of 2	
Factory default:	Yes
Shared Infusion Settings	
PC Unit	
Pump Module	
SPO2 Module	
>Select an Option or EXIT	
EXIT	PAGE DOWN

2. Press **Factory default** soft key.

3. Press **No** soft key.

System Configuration	
Factory Default Settings?	Yes
	<b>No</b>
Selection of Yes sets all System Configuration parameters to the factory default setting.	
EXIT	

4. To accept change, press **EXIT** soft key.
  - Option setting changes and main **System Config - Module** screen displays.

### 2.4 CONFIGURATION SETUP - SYRINGE MODULE

#### NOTES:

- Pressing the **EXIT** soft key while in a **System Config - Module** screen immediately powers the system down, with no "Powering Down" display.
- Pressing the **EXIT** soft key while in a **System Config - Syringe** screen returns the display to the main **System Config - Module** screen.

## 2.4 CONFIGURATION SETUP - SYRINGE MODULE (Continued)

### NOTES: (Continued)

- Pressing the **CONFIRM** soft key while in a System Configuration option screen:
  - accepts existing setting or setting change
  - displays next option setting screen (if applicable) or returns display to **System Config - Syringe** screen
- Pressing the PC Unit **CANCEL** key while in a System Configuration option screen:
  - leaves setting unchanged
  - returns display to **System Config - Syringe** screen

To access System Configuration options:

- Hold **OPTIONS** key at power up.

System Config - Module 1 of 2	
Factory default:	No
Shared Infusion Settings	
PC Unit	
Pump Module	
SPO2 Module	
>Select an Option or EXIT	
EXIT	PAGE DOWN

- Press **PAGE DOWN** soft key.

System Config - Module 2 of 2	
Syringe Module	
EtCO2 Module	
>Select an Option or EXIT	
PAGE UP	EXIT

- Press **Syringe Module** soft key.

System Config - Syringe 1 of 2	
All Mode:	Disabled
Auto Pressure:	Disabled
Back Off:	Disabled
Fast Start:	Disabled
KVO:	Disabled
>Select an Option or EXIT	
EXIT	PAGE DOWN

- To view additional options, press **PAGE DOWN** soft key.

System Config - Syringe 2 of 2	
Max rate:	999 mL/h
Near End:	Disabled
Pressure limit-Disc:	1000 mmHg
Pressure limit-NoDisc:	Med
Priming:	Disabled
>Select an Option or EXIT	
PAGE UP	EXIT

### 2.4.1 All Mode

Enabling **All mode** allows **ALL** to be selected as the volume to be infused (VTBI), to deliver the entire contents of the syringe.

#### CAUTION

If KVO and ALL modes are both enabled, the ALL mode will not deliver the entire syringe contents. A small percentage of the syringe contents will be left available for KVO operation.

### 2.4 CONFIGURATION SETUP - SYRINGE MODULE (Continued)

#### 2.4.1 All Mode (Continued)

1. After accessing **System Config - Syringe** options display, press **All Mode** soft key.

System Configuration - Syringe	
<b>All mode</b>	Enable Disable
Allows use of the All mode feature.	

2. To change option setting, press soft key next to applicable option (**Enable** or **Disable**).
  - Option setting changes and **System Config - Syringe** page 1 displays.

#### 2.4.2 Auto Pressure

Enabling **Auto Pressure** allows the Auto Pressure option to be displayed in the Pressure Limit screen when a pressure sensing disc is in use. Auto Pressure automatically sets the alarm limit for a shorter time to alarm, as follows:

- If current pressure is 100 mmHg or less, system adds 30 mmHg to current pressure, to create a new alarm limit.
- If current pressure is greater than 100 mmHg, system adds 30% to current pressure, to create a new alarm limit.

1. After accessing **System Config - Syringe** options display, press **Auto Pressure** soft key.

System Configuration - Syringe	
<b>Auto Pressure</b>	Enable Disable
Allows use of the auto pressure feature.	

2. To change option setting, press soft key next to applicable option (**Enable** or **Disable**).
  - Option setting changes and **System Config - Syringe** page 1 displays.

#### 2.4.3 Back Off

When **Back Off mode** is enabled and a pressure sensing disc is in use, the motor reverses plunger movement during an occlusion until the pressure returns to preocclusion levels, automatically reducing bolus flow.

1. After accessing **System Config - Syringe** options display, press **Back Off** soft key.

System Configuration - Syringe	
<b>Back Off mode</b>	Enable Disable
Allows use of the back off feature.	

2. To change option setting, press soft key next to applicable option (**Enable** or **Disable**).
  - Option setting changes and **System Config - Syringe** page 1 displays.

## 2.4 CONFIGURATION SETUP - SYRINGE MODULE (Continued)

### 2.4.4 Fast Start

When **Fast Start mode** is enabled and a pressure sensing disc is in use, the instrument runs at an increased rate when an infusion starts, taking up any slack in the drive mechanism.

1. After accessing **System Config - Syringe** options display, press **Fast Start** soft key.

System Configuration - Syringe	
Fast Start mode	Enable <b>Disable</b>
Allows use of the fast start feature.	

2. To change option setting, press soft key next to applicable option (**Enable** or **Disable**).
  - Option setting changes and **System Config - Syringe** page 1 displays.

### 2.4.5 KVO

Enabling **KVO** allows some infusions to automatically switch into KVO (keep vein open) mode upon completion. The KVO option setting cannot be changed after the instrument is powered on and a profile selected.

### CAUTION

If KVO and ALL modes are both enabled, the ALL mode does not deliver the entire syringe contents, leaving a small percentage of the syringe contents available for KVO operation.

**NOTE:** In the following procedure, the **KVO** option is changed to **Enable**. Changing the option setting to **Disable**, disables the **Change Rate** and **Change Volume** soft keys, as displayed in step 1.

1. After accessing **System Config - Syringe** options display, press **KVO** soft key.

System Configuration - Syringe	
KVO	Enable <b>Disable</b>
Rate: 1 mL/h	Change Rate
Volume: 2%	Change Volume
Allows use of the KVO feature.	
CONFIRM	

2. To change option setting, press soft key next to applicable option (**Enable** or **Disable**).

System Configuration - Syringe	
KVO	<b>Enable</b> Disable
Rate: 1 mL/h	Change Rate
Volume: 2%	Change Volume
Allows use of the KVO feature.	
CONFIRM	

## CHECKOUT AND CONFIGURATION

### 2.4 CONFIGURATION SETUP - SYRINGE MODULE (Continued)

#### 2.4.5 KVO (Continued)

- To change KVO rate, press **Change Rate** soft key and enter new rate (0.01 to 2.5 mL/h in 0.01 mL/h increments).

**NOTE:** Flow rates less than 0.01 mL/h are available only with a 1 cc syringe. For larger syringes, the lower limit adjusts to 0.1 mL/h.

System Configuration - Syringe	
KVO	Enable
Rate:	Disable
2 mL/h	<b>Change Rate</b>
Volume:	Change Volume
2%	
Allows use of the KVO feature.	
CONFIRM	

- To change KVO volume, press **Change Volume** soft key and enter new volume level (0.5 to 5%).

System Configuration - Syringe	
KVO	Enable
Rate:	Disable
2 mL/h	Change Rate
Volume:	<b>Change Volume</b>
5%	
Allows use of the KVO feature.	
CONFIRM	

- To accept changes(s), press **CONFIRM** soft key.

- Settings change and **System Config - Syringe** page 1 displays.

#### 2.4.6 Max rate

The **Maximum rate** value identifies the maximum rate at which a bolus dose can be delivered. When the **Max Rate** option is selected during bolus dose programming, the bolus is delivered at the maximum rate for an automatically calculated duration.

- After accessing **System Config - Syringe** options display, page 2, press **Max rate** soft key.

System Configuration - Syringe	
Maximum rate adjustment	
Maximum rate:	Change Value
999 mL/h	Confirm

- To change maximum rate, press **Change Value** soft key and enter new rate (0.1 to 99.9 mL/h in 0.1 mL/h increments; 100 to 999 mL/h in 1 mL/h increments).

System Configuration - Syringe	
Maximum rate adjustment	
Maximum rate:	<b>Change Value</b>
_ _ _ mL/h	

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## 2.4 CONFIGURATION SETUP - SYRINGE MODULE (Continued)

### 2.4.6 Max rate (Continued)

System Configuration - Syringe	
Maximum rate adjustment	
Maximum rate: 99.9 mL/h	<div>Change Value</div> <div>Confirm</div>

- To accept change, press **Confirm** soft key.

- Setting changes and **System Config - Syringe** page 2 displays.

### 2.4.7 Near End

Enabling **Near-End-of-Infusion** (NEOI) allows an alert to be set from 1 to 60 minutes before the infusion is complete. The alert occurs at the configured time or when 25% of the VTBI remains, whichever occurs later.

**NOTE:** In the following procedure, the **Near End** option is changed to **Enable**. Changing the option setting to **Disable** disables the **Change Time** soft key, as displayed in step 1.

- After accessing **System Config - Syringe** options display, page 2, press **Near End** soft key.

System Configuration - Syringe	
<b>Near-End-of Infusion</b>	<div>Enable</div> <div><b>Disable</b></div>
Alert Time: 2 min	<div>Change Time</div>
Allows use of the Near-End-of Infusion feature.	
<div>CONFIRM</div>	

- To change option setting, press soft key next to applicable option (**Enable** or **Disable**).

System Configuration - Syringe	
<b>Near-End-of Infusion</b>	<div><b>Enable</b></div> <div>Disable</div>
Alert Time: 2 min	<div>Change Time</div>
Allows use of the Near-End-of Infusion feature.	
<div>CONFIRM</div>	

- To change **Alert Time**, press **Change Time** soft key and enter new time (1 to 60 minutes).

System Configuration - Syringe	
<b>Near-End-of Infusion</b>	<div>Enable</div> <div>Disable</div>
Alert Time: 10 min	<div><b>Change Time</b></div>
Allows use of the Near-End-of Infusion feature.	
<div>CONFIRM</div>	

- To accept changes(s), press **CONFIRM** soft key.
  - Settings change and **System Config - Syringe** page 2 displays.

### 2.4 CONFIGURATION SETUP - SYRINGE MODULE (Continued)

#### 2.4.8 Pressure Limit - Disc

This option allows setting an occlusion pressure point when a pressure sensing disc is in use.

1. After accessing **System Config - Syringe** options display, page 2, press **Pressure limit-Disc** soft key.

System Configuration - Syringe	
Pressure Limit Selection (disc present)	
Current limit 1000 mmHg	Change Value
CONFIRM	

2. To change pressure limit, press **Change Value** soft key and enter new limit (25 to 1000 mmHg in 1 mmHg increments).

System Configuration - Syringe	
Pressure Limit Selection (disc present)	
Current limit _ 600 mmHg	Change Value
CONFIRM	

3. To accept change, press **CONFIRM** soft key.
  - Setting changes and **System Config - Syringe** page 2 displays.

#### 2.4.9 Pressure limit - No Disc

This option allows setting an occlusion pressure point when no pressure sensing disc is in use.

1. After accessing **System Config - Syringe** options display, page 2, press **Pressure limit-NoDisc** soft key.

System Configuration - Syringe	
Pressure Limit Selection (no disc)	
Low	Med
High	
CONFIRM	

2. To change pressure limit (occlusion pressure set point), press applicable soft key (**Low**, **Med**, **High**).

System Configuration - Syringe	
Pressure Limit Selection (no disc)	
Low	Med
High	
CONFIRM	

3. To accept change, press **CONFIRM** soft key.
  - Setting changes and **System Config - Syringe** page 2 displays.



## 2.4 CONFIGURATION SETUP - SYRINGE MODULE (Continued)

### 2.4.10 Priming

Enabling **Priming mode** allows a limited volume of fluid to be delivered to prime the administration set before connecting to a patient or following a syringe change. When priming, a single continuous press of the **PRIME** soft key delivers up to 2 mL of priming fluid.

1. After accessing **System Config - Syringe** options display, page 2, press **Priming** soft key.

System Configuration - Syringe	
<b>Priming mode</b>	Enable
	<b>Disable</b>
Allows use of the priming feature.	

2. To change option setting, press soft key next to applicable option (**Enable** or **Disable**).
  - Option setting changes and **System Config - Syringe** page 2 displays.

## 2.5 CONFIGURATION SETUP - SHARED INFUSION - PUMP AND SYRINGE MODULES

Refer to the 8000/8100 Series Technical Service Manual.

## 2.6 CONFIGURATION OPTIONS AND DEFAULTS - PCA MODULE

**NOTE:** With the Profiles feature enabled, the settings are configured independently for each profile. A hospital-defined, best-practice data set must be uploaded to enable the Profiles feature. Date and Time is a system setting and is the same in all profiles.

**System Settings:** Refer to the PC Unit section of the Alaris® System DFU.

**PCA Module Settings:** Refer to the PCA Module section of the Alaris® System DFU.

**PCA Module Configuration Parameters:** Select system configuration settings for the PCA Module during data set development, then upload them as part of the data.

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## Chapter 3 — PREVENTIVE MAINTENANCE

### **WARNING**

Failure to perform regular and preventive maintenance inspections may result in improper instrument operation.

### **3.1 INTRODUCTION**

Perform regular and preventive maintenance inspections to ensure that the Syringe and PCA Modules remain in good operating condition:

- Perform regular inspections before each use.
- Perform preventive maintenance inspections annually.

These requirements and guidelines are intended to complement the intent of Joint Commission on Accreditation of Healthcare Organizations (JCAHO) requirements.

### **3.2 REGULAR AND PREVENTIVE MAINTENANCE INSPECTIONS, CALIBRATION**

Use the Maintenance Software to perform calibration and preventive maintenance.

Contact Cardinal Health Technical Support for help obtaining or using Maintenance Software.

### **3.3 CLEANING**

Refer to the Alaris® System DFU.

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## Chapter 4 — PRINCIPLES OF OPERATION

### 4.1 INTRODUCTION

This chapter describes the principles of operation for the Syringe and PCA Modules.

Refer to the PC Unit/Pump Module (8000/8100 Series) Technical Service Manual for PC Unit information.

### 4.2 GENERAL INFORMATION

The Syringe and PCA Modules function as part of the Alaris® System, and function only when attached to a PC Unit.

- **PCA Module:** the PCA Module includes a locking security door and patient handset. Only one PCA Module can be attached to the PC Unit, and the PCA Module must be attached directly to the right of the PC Unit.
- **Syringe Module:** the Syringe Module includes a pressure sensing subsystem for use with administration sets that include pressure discs. Up to four Syringe Modules can be attached to the PC unit.
- Both modules can be used in conjunction with any combination of other Alaris® Modules.

Both modules are appropriate for intermittent or continuous delivery of IV fluids. Both modules can provide smooth delivery of small quantities of IV fluid within a very low contained volume. Both modules include these advanced features: bolus delivery, drug library, drug dose calculator, loading dose, titrate without stopping, syringe size detector, one-handed syringe loading, several modes of delivery, multi-channel coordinated infusion, and dose limits.

### 4.2 GENERAL INFORMATION (Continued)

Both the Syringe and PCA Modules include display, logic, drivetrain, drive head, plunger, and force sensor subsystems.

**NOTE:** All circuit boards in the Syringe and PCA Modules are not field repairable and must be returned to a Cardinal Health Service Center for repair.

### 4.3 DISPLAY BOARD ASSEMBLY

The keypad sends signals to the microcontroller on the Display Board, whose function is to manage displayed information. The Logic Board provides 5V power to the Display Board through a 10-pin connector.

#### 4.3.1 Microcontroller

The Display Board's microcontroller provides four keypad functions: Channel Select, Pause, Channel Off, and Restart. The microcontroller controls the keypad backlight and the Alarm, Infusing, and Standby LEDs.

The microcontroller controls the LED display driver for the Channel Identification (Channel ID) and 7-segment rate displays.

The microcontroller also drives the scrolling alphanumeric display that shows module status (such as "INFUSION COMPLETE" or "CHANNEL MALFUNCTION").

The microcontroller performs safety monitoring and generates alerts (including the Alarm LED and applicable error messages) if critical circuitry does not function properly.

#### 4.3.2 LED Display Driver

The microcontroller communicates serially with the LED driver for the 8-digit, 7-segment LED display.

The display driver uses a discrete resistor for brightness control. Module software provides three brightness levels: low (27% of full brightness), used when the PC Unit is operating on battery power; medium (47% of full brightness), used when the PC Unit is operating on AC power; and high (100% brightness) is the maximum level possible.

#### Rate:

The display driver controls the five 7-segment displays used for the Rate display: three 7-segment displays and two small 7-segment displays (the smaller displays show fractional digits). The five displays show infusion rates from 0.01 mL/h to 999 mL/h. The Rate display is readable in normal hospital lighting conditions from a distance of 15 feet and provides a 45° viewing angle.

#### Channel Identification:

The display driver controls the 14-segment Channel ID display, which can display letters A through H. The Channel ID display is readable in normal hospital lighting conditions from a distance of 15 feet and provides a 45° viewing angle.

#### 4.3.3 Comparator/Safety Monitor

The comparator/safety monitor circuit detects short or open failures of the Alarm LED or rate display and sends that information to the microcontroller. This ensures correct alarm notification and prevents the module from displaying an invalid infusion rate.

#### 4.3.4 Status and Backlight LEDs

A constant current drives and ensures consistent brightness levels for the three status LEDs (Alarm, Infusing, Standby) and the keypad backlight LED.

#### 4.4 LOGIC BOARD ASSEMBLY

The Logic Board receives its power from the 8V supply on the PC Unit via the IUI connector. The Logic Board contains DC-to-DC converters to convert the +8V supply to +3.3V, +5V, and +15V supplies, and a variable voltage supply to the motor. The Logic Board also contains an inverting circuit to produce a -5V supply. The field-programmable gate array (FPGA) on the Logic Board controls the supply voltages (5V, 3.3V) to the digital and analog sensors.

The Logic Board monitors the supply voltages and analog sensor signals, and sets up the nominal power level for any particular pumping rate. Incoming analog sensor signals (from the pressure sensor, force sensor, syringe sizer, and plunger position sensor) are filtered and buffered, and then fed to the ADC as inputs.

The Logic Board includes a processor, a 1M x 8 flash ROM, 512K x 8 static RAM, and a watchdog timer circuit. The watchdog timer circuit has a 1.6-second timeout that can put the Syringe or PCA Module into a safe state if the Logic Board main processor fails.

The Logic Board reads and writes to the FPGA via I/O address space. The FPGA contains the digital logic for generating control signals for ADC, DAC, sensors, motor feedback circuitry, module detection and identification circuit interface, and 10-phase step signals for the motor drive circuitry. The FPGA also generates a master RESET signal for the module.

The Logic Board's main processor communicates with the Display Board's microcontroller via a serial channel. The Logic Board provides the Power-On Reset signal to the Display Board. Upon keypad input to the Display Board, the Logic Board

receives a Channel Off signal to stop the motor.

The Logic Board contains IUI interface circuitry that allows it to communicate with the PC Unit.

The digital sensor interface on the Logic Board contains current sense circuitry, which reads output signals from the photointerrupters on the lever detect sensor, nut engaged sensor, and flange sensor. On the Syringe Module only, the Logic Board also reads signals from the SET IN sensor (pressure sensor).

The motor drive circuitry on the Logic Board uses a variable voltage supply to drive a 5-phase stepper motor and save power, depending on the torque loading. A combination of software settings and motor feedback loop circuitry adjusts the motor supply voltage in response to detected motor loading. The motor feedback loop starts with a nominal voltage based on pumping rate, and adjusts motor voltage as needed to maintain constant peak motor current levels, independent of torque load. The motor feedback loop keeps the voltage range constant for any given pumping rate.

#### 4.5 DRIVETRAIN ASSEMBLY

The drivetrain is a linear positioning device. The geared stepper motor powers the drivetrain, and the linear motion of the drivetrain controls the drive head to push the syringe plunger accurately and with enough force to deliver medication from many different syringes. Because system positioning is open loop, the mechanical parts and assembly must maintain a high degree of accuracy.

### 4.6 DRIVE HEAD

The drive head captures the syringe by the syringe plunger and uses the drivetrain to drive the plunger in a controlled fashion. The drive head has claw-like arms (plunger grippers) that capture the syringe plunger. The plunger grippers allow the drive head to capture a wide variety of syringes (see the Syringe or PCA Module section of the Alaris® System DFU and Set Compatibility Card for more information on suitable syringes).

To load a syringe into the drive head, the gripper control/drive head release lever rotates 90° clockwise. This rotates an inner shaft, which is connected to a slide plate. Two holes in the slide plate interface with two pinion gears that make direct contact with the plunger grippers. Once the slide plate moves back, the gears rotate and the plunger grippers open to accept the syringe plunger flange.

Once the syringe is loaded, a plunger detect flag interfaces with an optical switch to indicate that a syringe is properly loaded into the plunger grippers. The drive head also includes a flag that indicates the drive head position, preventing an infusion from beginning prematurely.

Several other components of the drive head control the opening and closing of the split nuts on the leadscrew. A pull rod cam attached to the end of the rotating shaft in the drive head interfaces with a rod and head piece that can rotate to lift the rod attached to the drivetrain carriage and cam lock at the other end, allowing the split nuts to open. Once the rotating shaft rotates clockwise to load a syringe and then released, a torsion spring returns the gripper control to its original position. This torsion spring ensures that the gripper control

returns to its vertical (closed) position and confirms that the split nuts are closed.

The drivetrain is contained in the lower and upper housings. The lower housing is also attached to the drive tube that connects to the drivetrain carriage at the opposite end. A plastic sleeve over the drive tube provides environmental and ESD protection to the flex circuit routed up to the drive head.

### 4.7 PLUNGER HEAD BOARD ASSEMBLY

A strain gauge on the Plunger Head Board senses the force applied to the syringe plunger: the greater the force, the more negative the amplifier output. The resulting signal is inverted and offset on the Logic Board.

The optical switches on the Plunger Head Board detect whether a syringe is properly loaded and whether the plunger grippers are in position to capture a syringe plunger. When either optical switch is unblocked, current-sensing circuitry on the Logic Board detects a current from the switch.

### 4.8 FORCE SENSOR SUBSYSTEM

The force sensor subsystem includes a force sensor mounted in the drive head, rather than at the drivetrain as in other designs.

The cantilevered force sensor contact plate pivots on a lock plate mounted to the underside of the lower housing. The force sensor is positioned so that the cantilevered contact plate acts as a moment arm from the pivot point, providing mechanical advantage from the syringe force to the force sensor.

#### **4.8 FORCE SENSOR SUBSYSTEM** (Continued)

This mechanical advantage amplifies the input for a given force from a syringe, which improves system resolution. Improved resolution is particularly beneficial for smaller syringes with lower syringe forces.

A protrusion on the contact plate concentrates force from all syringe sizes to a specific location on the contact plate, which minimizes the effect of variations in syringe loading and in the syringe push button geometry inherent in plastic syringes. The protrusion also creates a longer moment arm for smaller size syringes, because they contact the protrusion further from the contact plate pivot. This increases the sensor force of small size syringes, allowing better system resolution. A silicone seal is also trapped between the force sensor and the lower housing.

#### **4.9 PRESSURE SENSOR SUBSYSTEM** (SYRINGE MODULE ONLY)

The pressure sensor subsystem includes the Pressure Sensor Board Assembly, disc detect system, and related hardware. The pressure sensor subsystem is only activated when an administration set with a pressure disc is used and the pressure disc is installed, and enhances overall pressure detection in the patient line.

The Pressure Sensor Board includes: a pressure sensing transducer that makes intimate contact with a flexible membrane (pressure disc) on the administration set. The pressure of the fluid in the administration set is transmitted through the membrane and into the gel of the sensor, where it is measured by a piezoresistive pressure transducer.

Circuitry on the Pressure Sensor Board amplifies pressure transducer output. The board also includes an optical switch that detects the presence of an administration set pressure disc.

#### **4.10 PATIENT HANDSET CIRCUIT AND DOOR LOCK SENSOR CIRCUIT (PCA MODULE ONLY)**

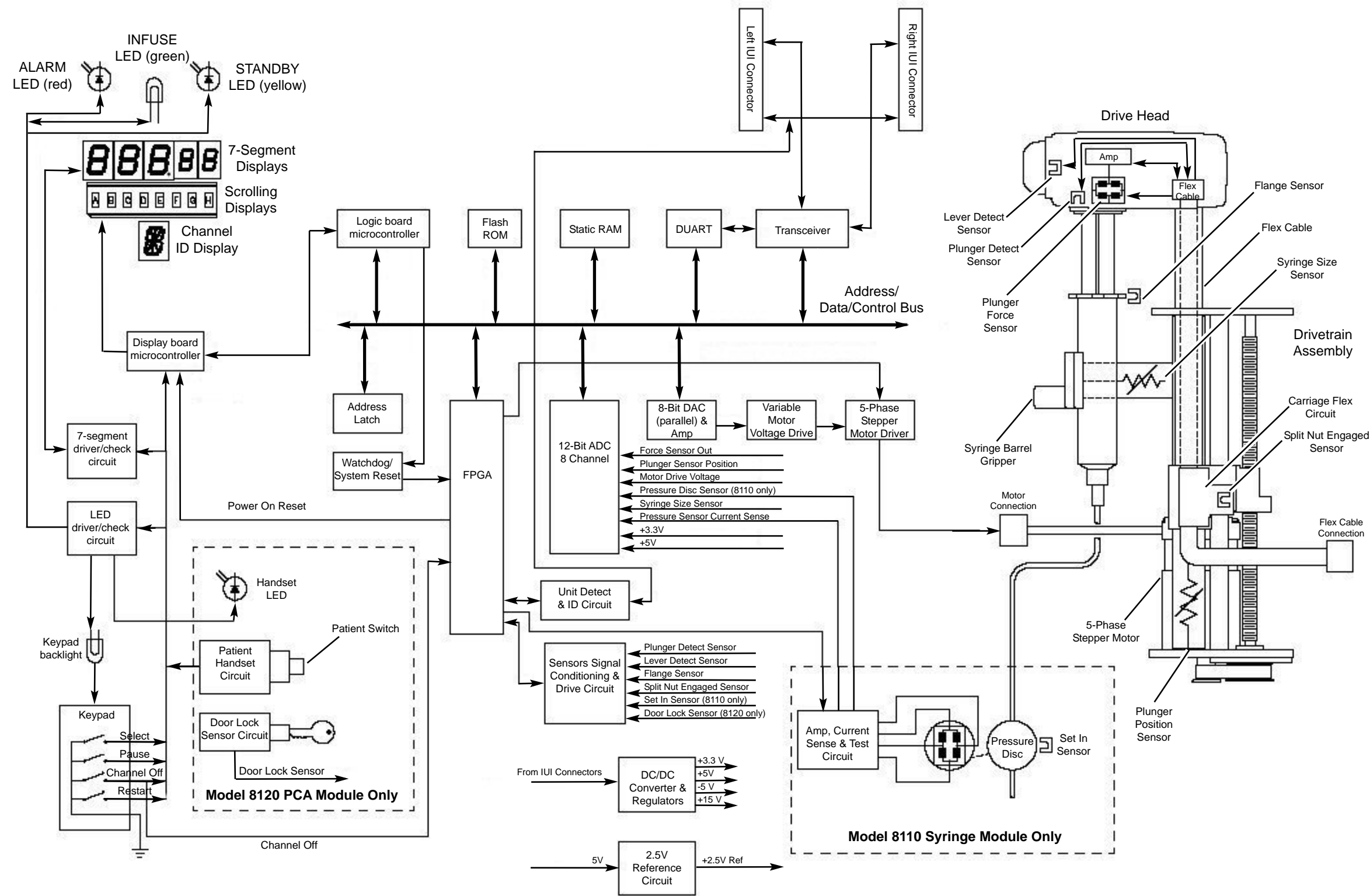
The PCA Module Logic Board includes a patient handset circuit, which senses whether a dose request cord is attached. A button on the dose request cord allows a patient to request a dose of analgesia according to clinician-programmed parameters.

The PCA Module Logic Board also includes a door lock sensor circuit that detects the position of the door lock (UNLOCK, PROGRAM, or LOCK):

- UNLOCK allows syringe loading or unloading, or access to the latch that allows the PCA Module to be detached.
- PROGRAM allows changes to programmed parameters without interrupting an infusion.
- LOCK is the only position that allows an infusion to start.

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Figure 4-1. Block Diagram: Syringe and PCA Modules



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## Chapter 5A — CORRECTIVE MAINTENANCE

### Syringe Module

#### WARNING

Disconnect the instrument from the Alaris® System before performing maintenance. Only qualified personnel using proper grounding techniques should open the instrument case.

#### CAUTION

CMOS devices are sensitive to static electrical charges and may be damaged during repair if the repair activity is not performed in an electrostatic discharge (ESD) protected environment using approved ESD protective procedures, including personnel grounding.

#### NOTES:

- Replacing the Complete Housing Assembly, Force Sensor Assembly or Logic Board Assembly in a Syringe Module with version 7.0 or earlier software requires special calibration equipment. Until version 7.1 or later is installed in the Syringe Module, these assemblies must be replaced at the depot. Call Cardinal Health Technical Support (800.854.7128 ext. 6003) for assistance and information.
- Due to product changes over time, components/ assemblies illustrated in this chapter may differ from the disassembled instrument. If there are any questions, contact Cardinal Health Technical Support.

#### 5.1 INTRODUCTION

This chapter describes how to disassemble and reassemble the Syringe Module.

For more efficient repair, read the “Principles of Operation” chapter for information on the mechanical and electrical functions of the Syringe Module.

The surface mount devices on the circuit boards are not field repairable. Return circuit boards to an authorized Cardinal Health Service Center for repair. Attempting circuit board repairs voids all warranties.

Whenever the Syringe Module is repaired, perform the minimum tests required for new instrument checkout using Maintenance Software.

For information on replacement parts, see the “Illustrated Parts Breakdown” chapter.

Following any level of maintenance, perform the applicable tests (refer to “Level of Testing Guidelines” table).

## 5.2 DISASSEMBLY/REASSEMBLY

Follow these procedures in order for the most efficient disassembly of Syringe Module subassemblies. To reassemble the Syringe Module, reverse the disassembly steps.

Before adhering gaskets and labels to the instrument, clean the surface with a cotton swab or soft cloth lightly dampened with 70% Isopropyl Alcohol.

### CAUTION

To avoid the risk of electrical hazard or damage to the instrument circuitry, do not spray fluids directly onto the instrument or allow fluids to enter the instrument.

**Table 5A-1. Required Materials, Supplies and Tools - Syringe Module**

**NOTE:** Contact/source information is subject to change.

- Silicone Grease, Dow Corning Molykote 33, or equivalent (<http://www.dowcorning.com>)
- #1 Phillips Screwdriver
- #2 Phillips Screwdriver
- Small Diagonal Cutters
- Lint-free cloth (such as, Kimwipes or lint-free tissue)

The following items may be purchased from TECHNI-TOOL (800.832.4866; <http://www.techni-tool.com>).

- Hex Head Bit,  $\frac{1}{16}$  HX,  $1\frac{15}{16}$ " Length, TT #758SC0172 (used for 0.062" Park Position Collar Setscrew)
- Power Bit, Ball Hex  $\frac{5}{64}$ ,  $\frac{1}{4}$  HX,  $3\frac{1}{2}$ " Length, TT #758SC0172
- Power Bit, Ball Hex  $\frac{3}{32}$ ,  $\frac{1}{4}$  HX,  $3\frac{1}{2}$ " Length, TT #758SC0173
- Torque Screwdriver with a minimum range of 3-15 in-lbs. Recommend torque screwdriver, Micro-Adjustable, TT #844SC5002 or TT #304TO034.
- Torx Bit, Size T6,  $1\frac{15}{16}$ " Length, TT #758SC0301

The following items may be purchased from McMaster-Carr (562.692.5911; <http://www.mcmaster.com>).

- Insert-Bit Holder,  $\frac{1}{4}$ " Hex Drive, 6" Length, #7225A42
- Insert-Bit, 0.05" Hex Size,  $\frac{1}{4}$ " Hex Shank, 1" Length, #8526A46 (used for 0.05" Park Position Collar Setscrew)
- Slotted Screwdriver,  $\frac{1}{8}$ " Tip Width, 3" Long Blade, #5682A37

## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.1 Removing Latch Assembly and Feet

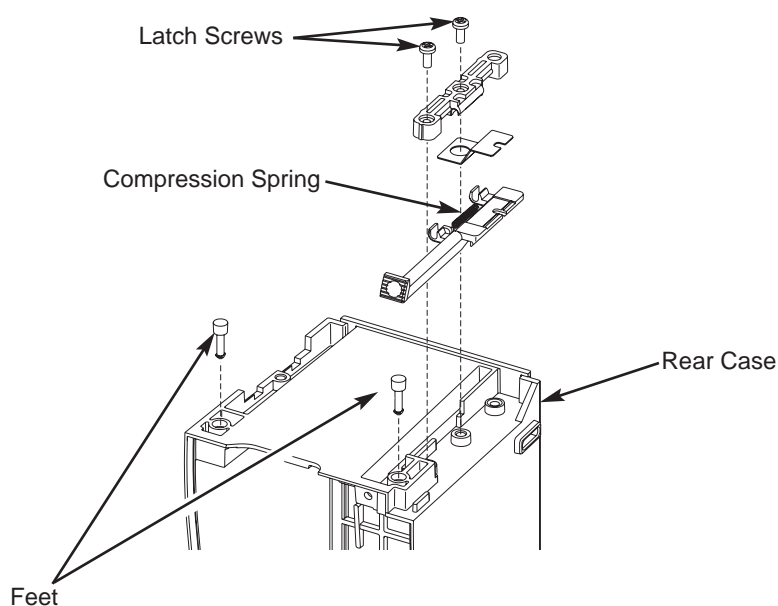
1. Remove two (2) screws attaching Latch Assembly to bottom of Rear Case and remove Latch Assembly Components.
2. Pull two (2) Feet from underside of module.

**NOTE:** When reinstalling the Compression Spring, be sure to orient as shown during reassembly.

#### During Reassembly:

Apply thin layer of Dow Corning Molykote 33 (or equivalent) silicone grease to Feet.

**NOTE:** The Feet press-fit into the module.



## CORRECTIVE MAINTENANCE

### Syringe Module

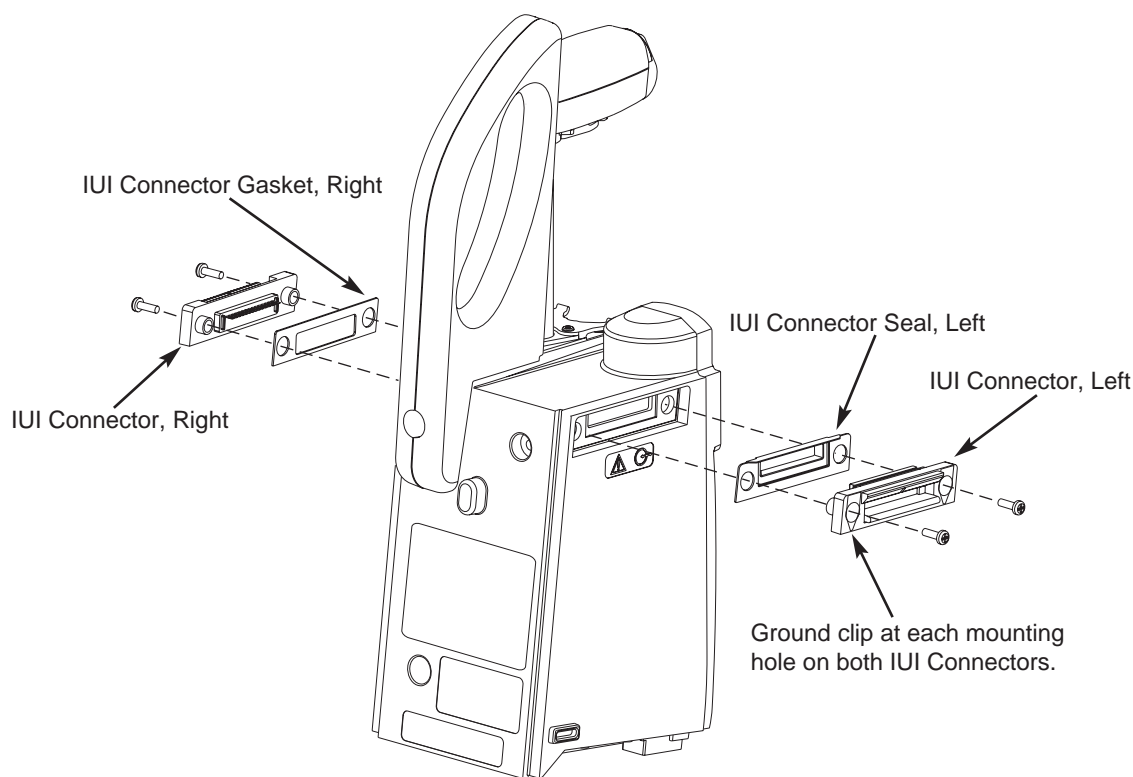
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.2 Removing IUI Connector Assemblies

Remove two (2) screws attaching each IUI (left and right) to module.

#### During Reassembly:

- Do not mix gray (old) and black (new) IUI Connectors.
- Ensure ground clips are still installed on both IUI connectors.
- To install Right IUI Connector Gasket, remove protective backing and adhere to IUI Connector.
- To install Left IUI Connector Seal, position seal on one end of connector and stretch to other end to conform to connector body. Gently press on seal to seat completely. Use lint-free swab to apply alcohol to top, sides, and bottom of seal for lubrication while installing to Rear Case. Do not apply alcohol to contacts or connector.



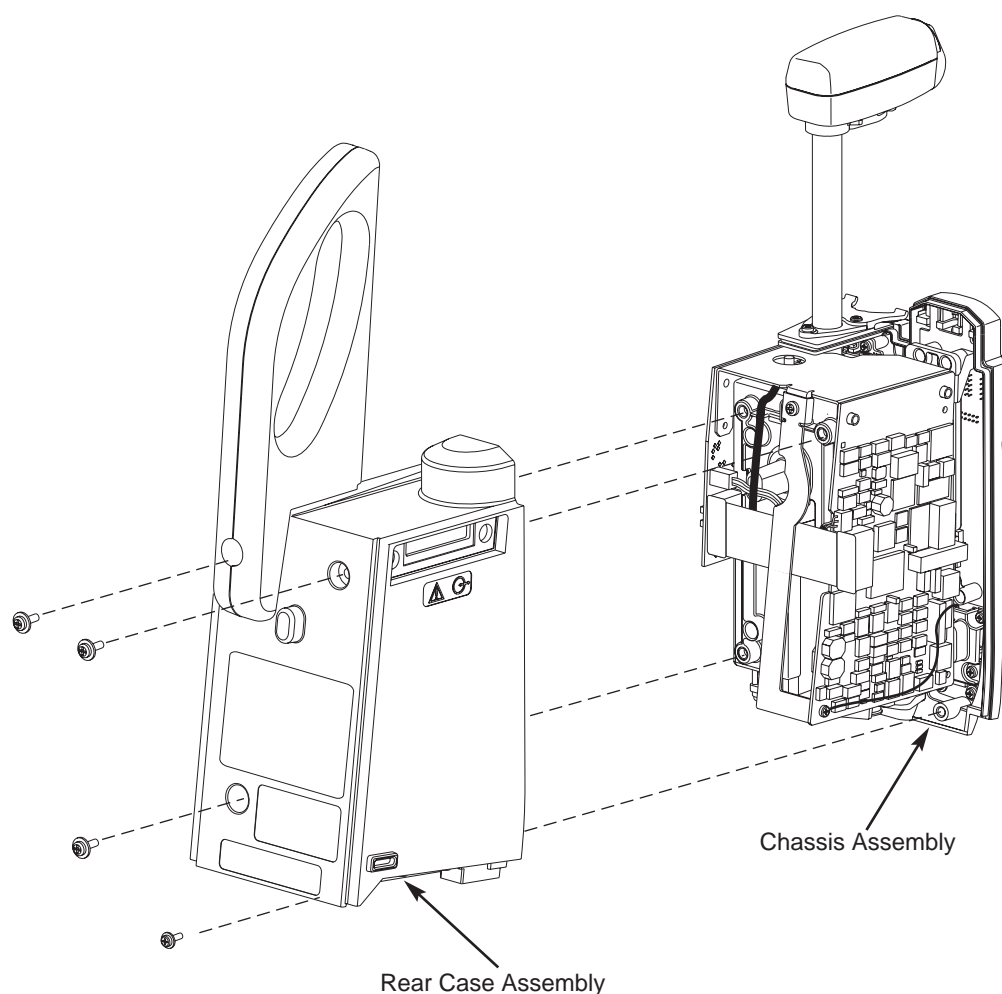
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.3 Separating Rear Case from Chassis Assembly

1. Remove four (4) screws (and associated washers) attaching Rear Case to chassis assembly.
2. Separate Rear Case from Front Case by pulling Rear Case away from chassis assembly.

#### During Reassembly:

- Ensure Silicone Tubing gasket in Rear Case is in place and undamaged. (See Figure 7A-12)
- Raise Drive Head to highest position before sliding Chassis Assembly into Rear Case.
- Ensure wiper assembly seals between cutout in rear case.



## CORRECTIVE MAINTENANCE

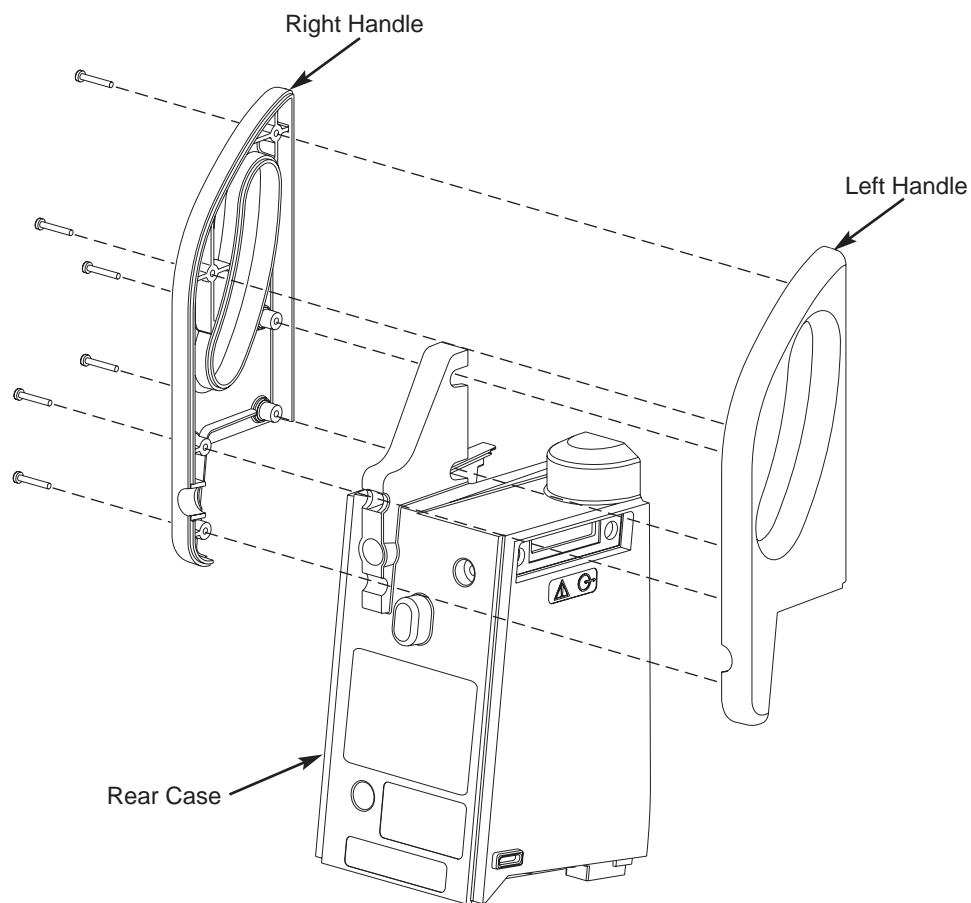
### Syringe Module

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## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.4 Removing Handle

Remove six (6) screws attaching left and right handles to each other and to module.





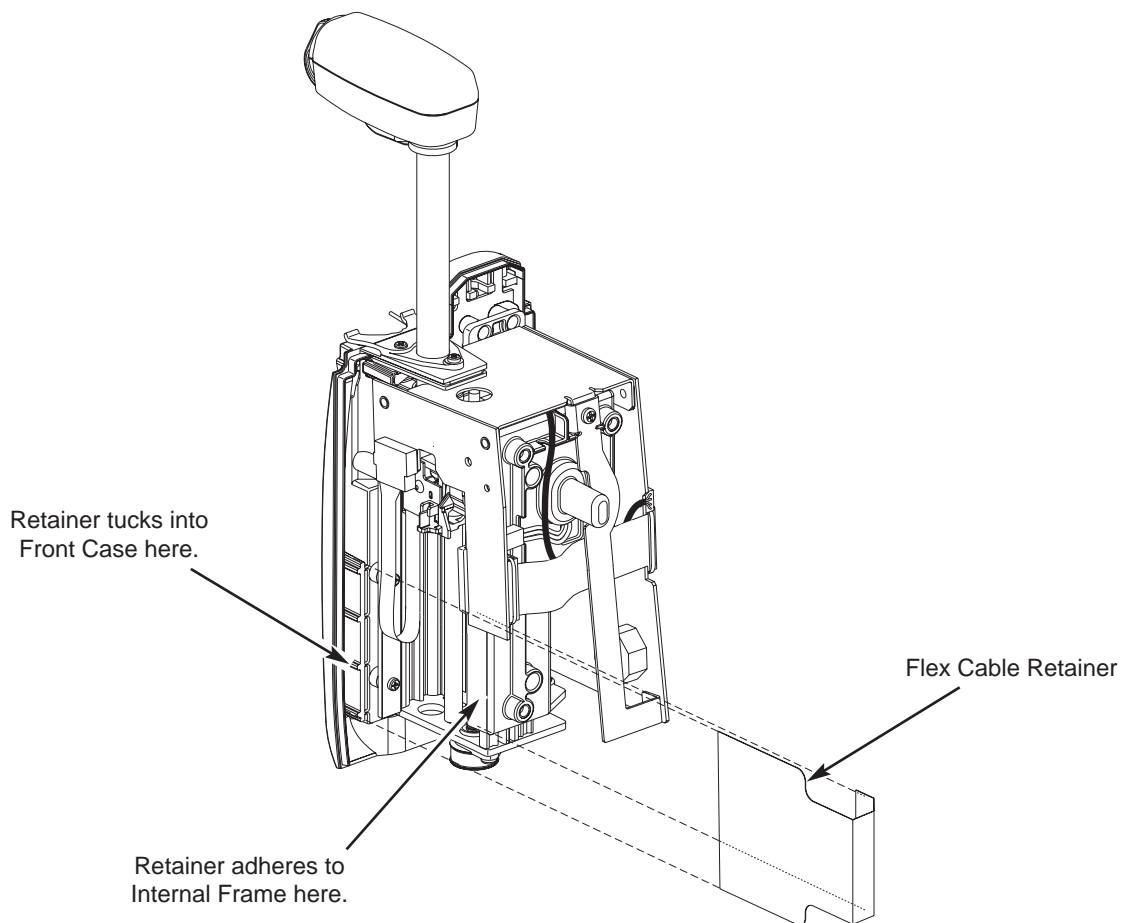
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.5 Removing Flex Cable Retainer

1. Peel Flex Cable Retainer from Internal Frame.
2. Use a cotton swab or soft cloth lightly dampened with 70% Isopropyl Alcohol to remove adhesive debris from Internal Frame.

### During Reassembly: (see Figure 7A-11)

1. Ensure Internal Frame surface (where retainer is adhered) is clean and free of adhesive debris.
2. Remove protective backing from replacement retainer and adhere retainer to Internal Frame.
3. If necessary, bend retainer on each fold line at a 90° angle, toward front of instrument.
4. Lay retainer over Flex Cable and tuck inside Front Case.



## CORRECTIVE MAINTENANCE

### Syringe Module

## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.6 Removing IUI Board Assembly

1. If present, remove Retainer Clip from Dual Connector Cable-IUI Board connection.
2. Disconnect Dual Connector Cable from IUI Board J2.
3. Disconnect Syringe Size Sensor harness from IUI Board J4.
4. Disconnect Flex Cable from IUI Board J3.

5. Use small diagonal cutters to lift and remove snap rivet from IUI Board.

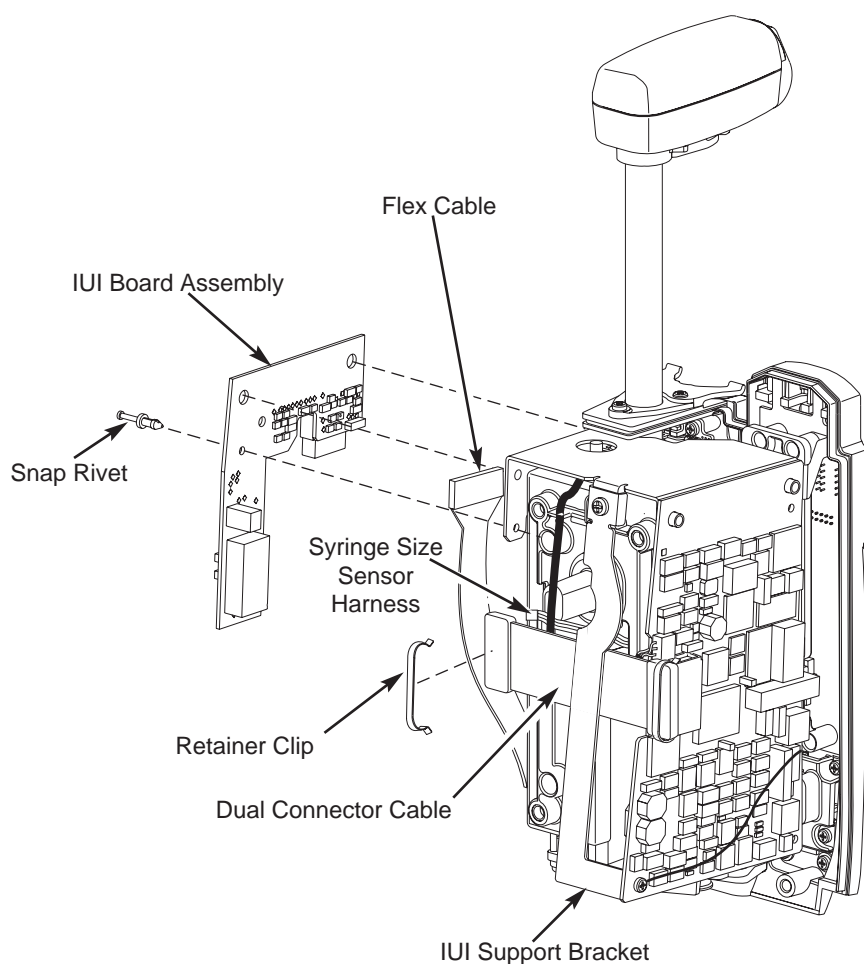
#### CAUTION

Do not cut rivet.

6. Remove IUI Board Assembly.

#### During Reassembly:

Route Dual Connector Cable and Syringe Size Sensor harness under IUI Support Bracket.



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

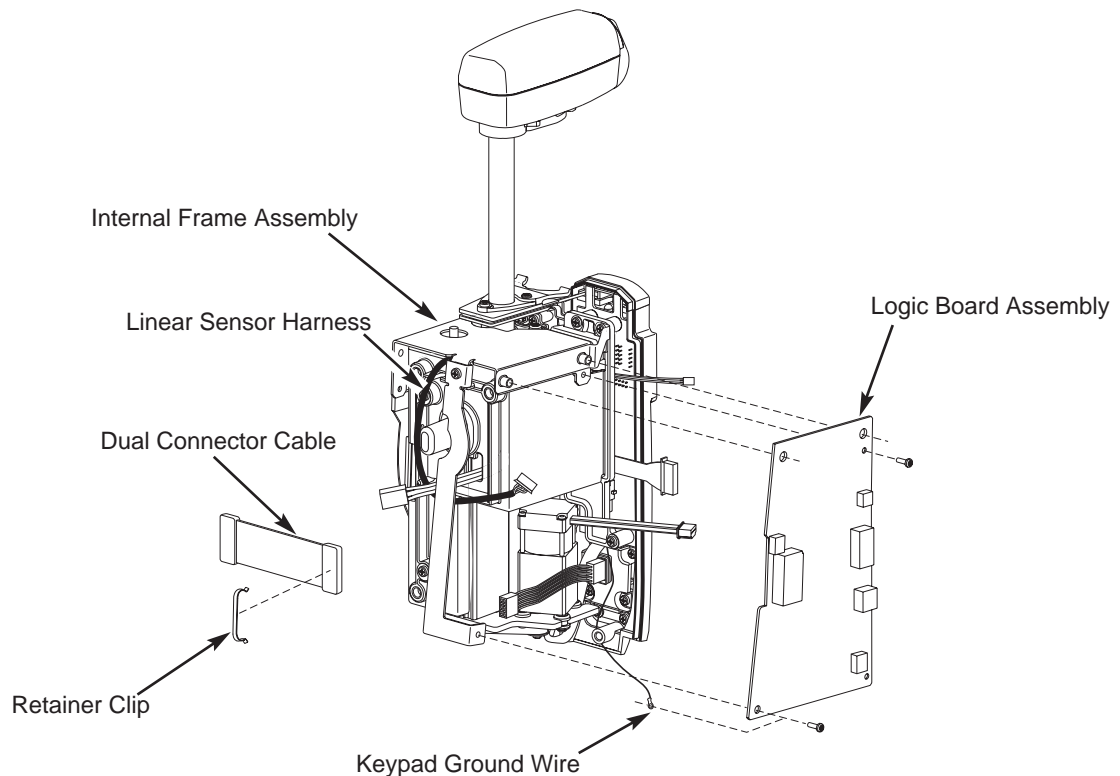
### 5.2.7 Removing Logic Board Assembly

**NOTE:** If the Logic Board must be replaced on a Syringe Module with version 7 or earlier software, the Logic Board must be replaced at the depot. See the note at the beginning of this chapter for more information.

1. If present, remove Retainer Clip from Dual Connector Cable-Logic Board connection.
2. Disconnect Dual Connector Cable from Logic Board J8.
3. Disconnect Linear Sensor harness from Logic Board J12.
4. Remove one (1) screw attaching Keypad ground wire and Logic Board to UII Support Bracket.
5. Remove one (1) screw attaching Logic Board to Internal Frame Assembly.
6. Disconnect harnesses from following locations on Logic Board:  
J4 (display)  
J7 (motor)  
J11 (flange detect)  
J14 (pressure sensor)
7. Remove Logic Board.

#### During Reassembly:

Route Dual Connector Cable and Linear Sensor Harness under UII Support Bracket.



## CORRECTIVE MAINTENANCE

### Syringe Module

## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.8 Removing Internal Frame Assembly

#### CAUTION

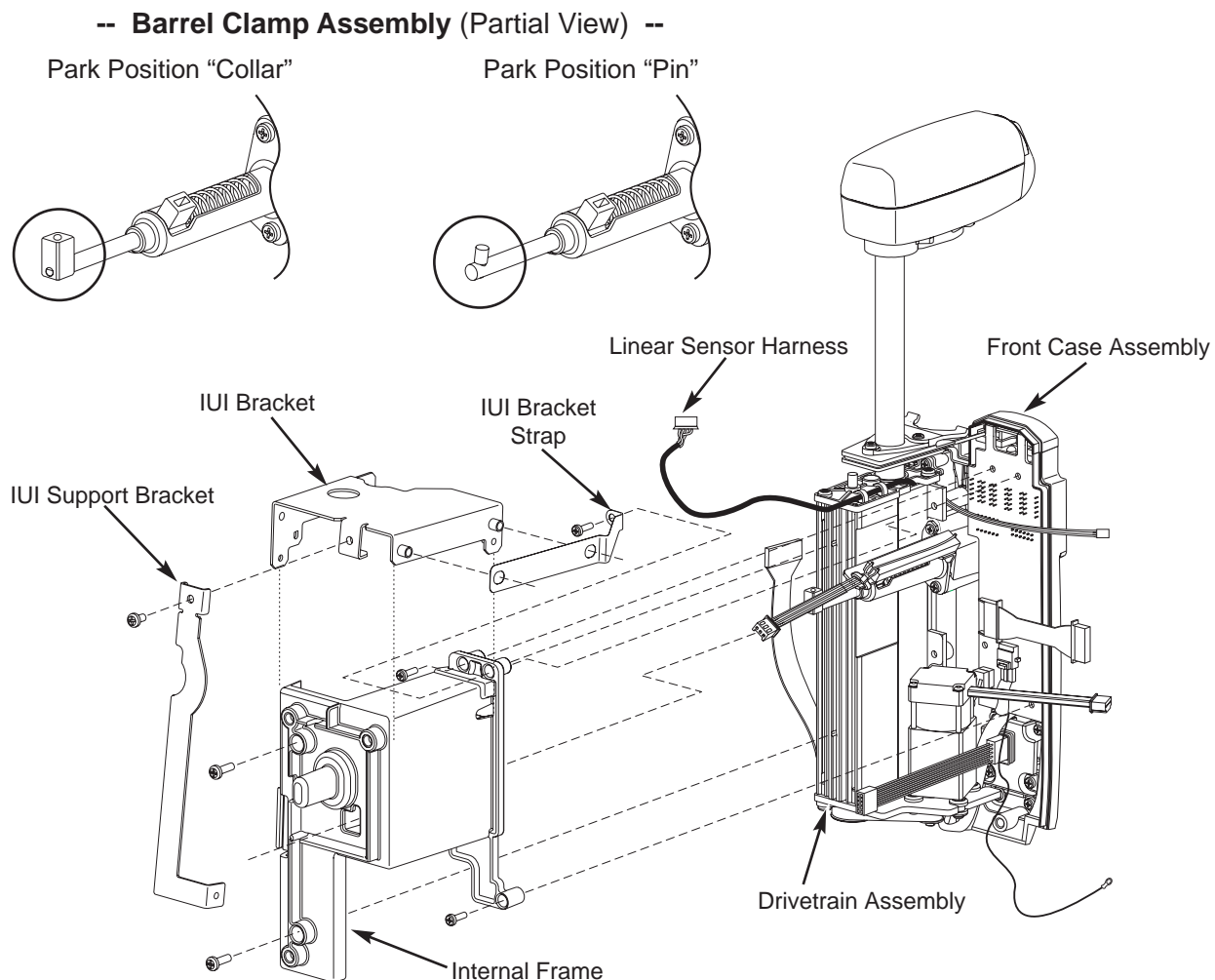
To replace an Internal Frame whose Barrel Clamp Assembly has a park position “pin” (rather than a “collar”), replace with Front Case Assembly Kit (Table 7A-1, item 9).

1. Remove three (3) screws attaching Internal Frame to Front Case Assembly.
2. Remove IUI Bracket Strap.

3. Remove one (1) screw attaching IUI Support Bracket to IUI Bracket.
4. Remove IUI Support Bracket and IUI Bracket.
5. Remove two (2) screws attaching Internal Frame to Drivetrain Assembly.
6. Remove Internal Frame.

#### During Reassembly:

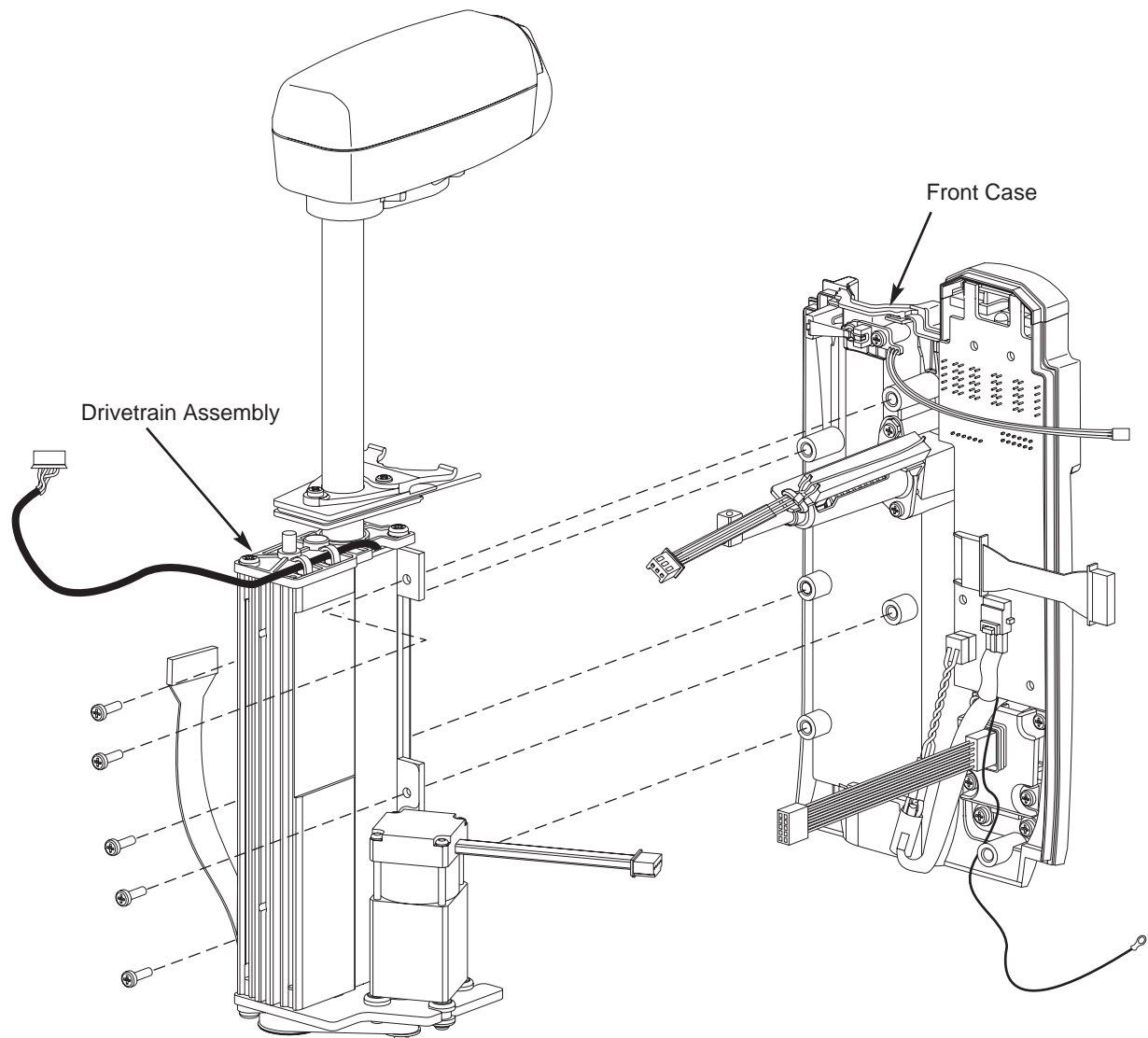
Route Linear Sensor Harness between IUI Bracket and Internal Frame.



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.9 Removing Drivetrain Assembly

1. Remove five (5) screws attaching Drivetrain Assembly to Front Case.
2. Remove Drivetrain Assembly.



## CORRECTIVE MAINTENANCE

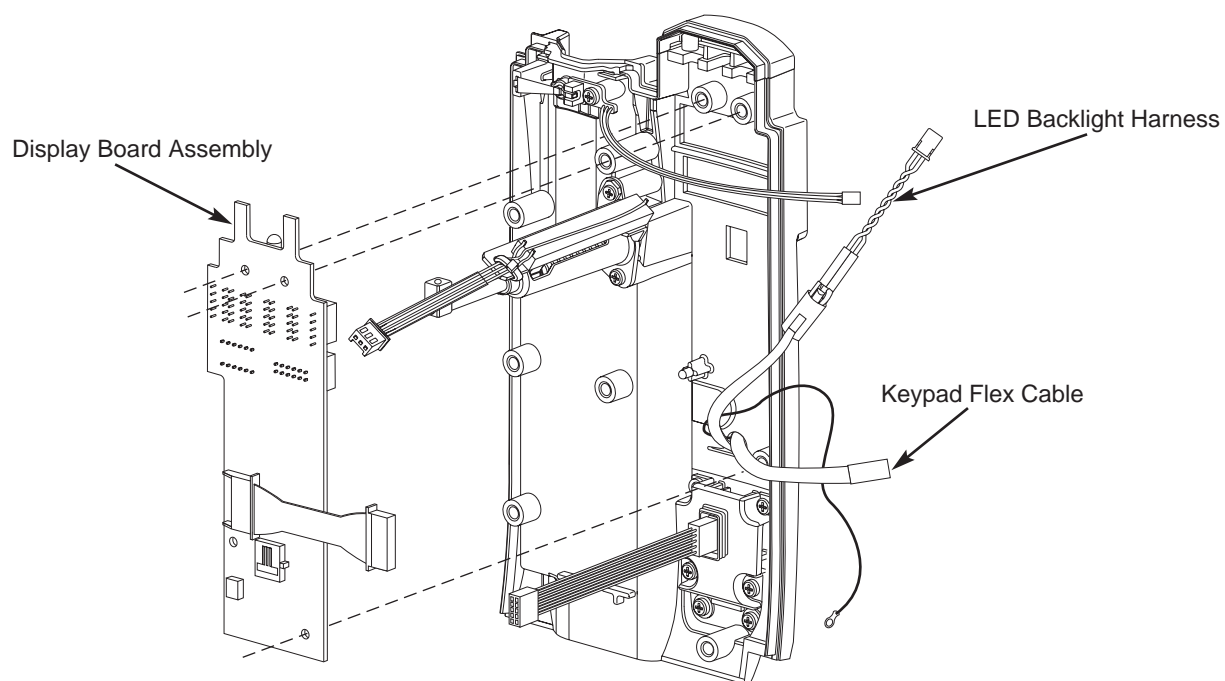
### Syringe Module

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## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.10 Removing Display Board Assembly

1. Disconnect harness/flex cable from following locations on Display Board:
  - J1 (keypad)
  - J4 (backlight)
2. Remove Display Board.



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.11 Removing Pressure Sensor Board Assembly

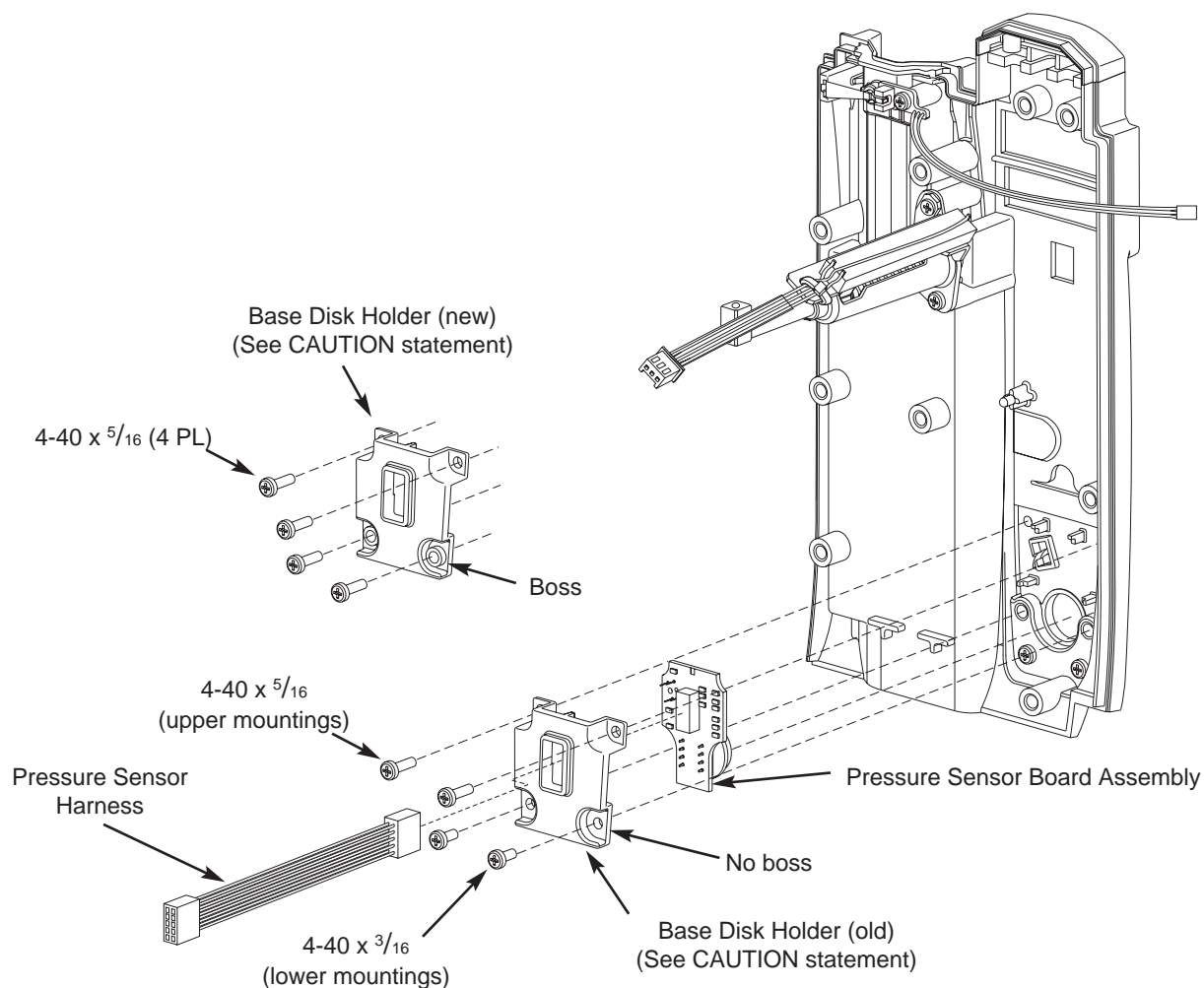
1. Disconnect Pressure Sensor Harness from Pressure Sensor Board.
2. Remove four (4) screws attaching Base Disk Holder to Top Disk Holder and Front Case.
3. Remove Base Disk Holder and Pressure Sensor Board Assembly.

#### During Reassembly:

When installing an old version of Base Disk Holder, use 4-40 x  $\frac{5}{16}$  screws (item 486) in upper mountings, and 4-40 x  $\frac{3}{16}$  screws (item 484) in lower mountings. When installing a newer version of Base Disk Holder, use 4-40 x  $\frac{5}{16}$  (item 486) for all mountings. (Reference Figure 7A-4.)

#### CAUTION

To avoid damage to the Front Case when reinstalling the Base Disk Holder, use correct size screws (reference Figure 7A-4).



## CORRECTIVE MAINTENANCE

### Syringe Module

## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.12 Removing Top Disk Holder

#### CAUTION

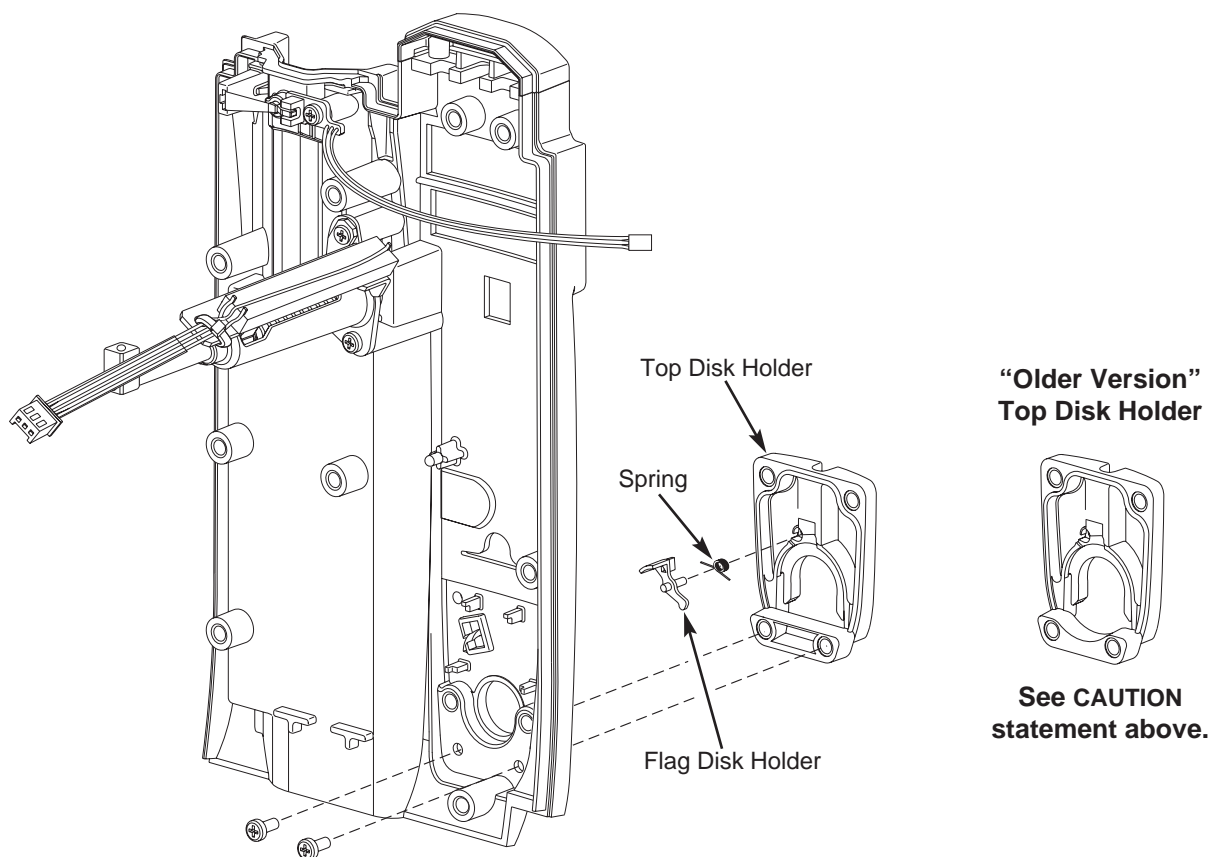
To replace “Older Version” Top Disk Holder (see below), replace with Front Case Assembly Kit (Table 7A-1, item 9).

1. Remove two (2) screws attaching Top Disk Holder to Front Case.
2. Remove Top Disk Holder.

**NOTE:** When replacing the Top Disk Holder, remove the Flag Disk Holder and Spring from the old part and reuse.

#### During Reassembly:

- Set spring torque by inserting end of Spring in hole of Flag Disk Holder and winding holder counterclockwise.
- Ensure Silicone Tubing and Gasket in Top Disk Holder mounting area on Front Case are in place and undamaged. (See Figure 7A-5)

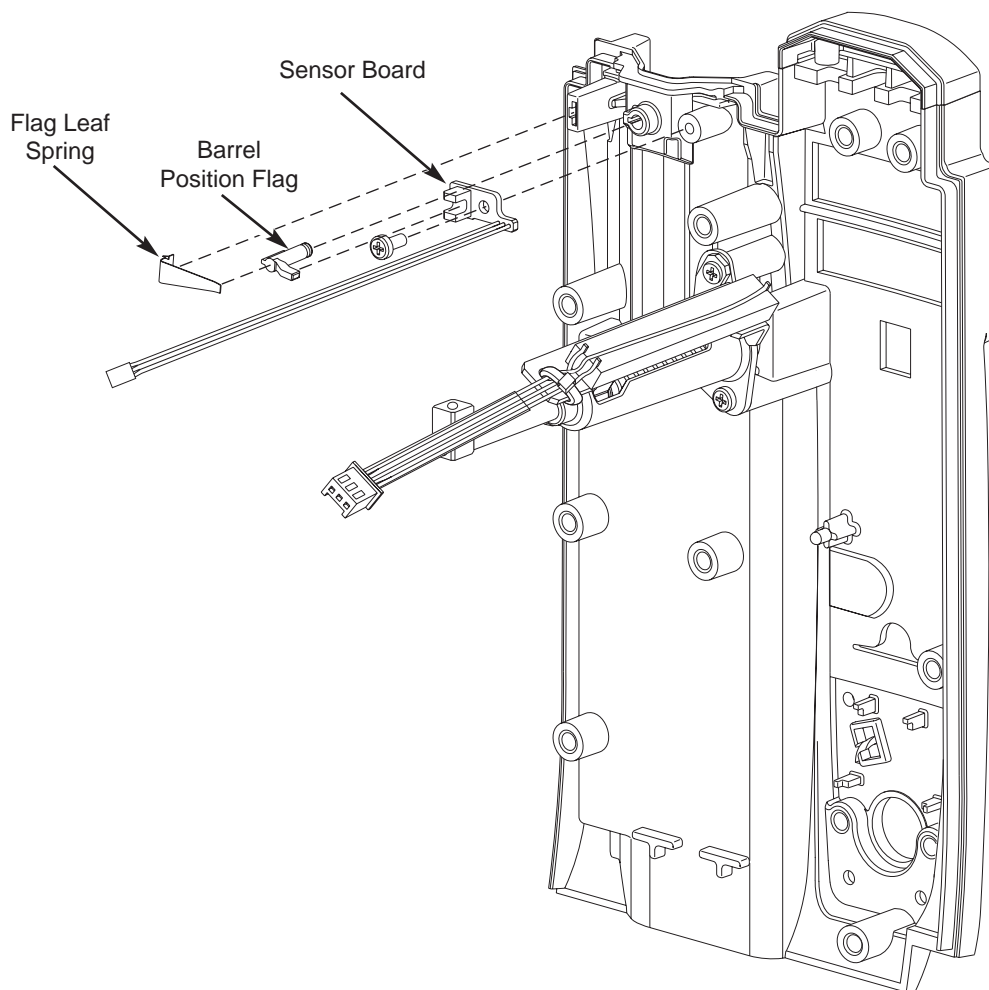




## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.13 Removing Sensor Board Assembly

1. Remove Flag Leaf Spring and Barrel Position Flag as required.
2. Remove one (1) screw attaching Sensor Board to Front Case.
3. Remove Sensor Board.



## CORRECTIVE MAINTENANCE

### Syringe Module

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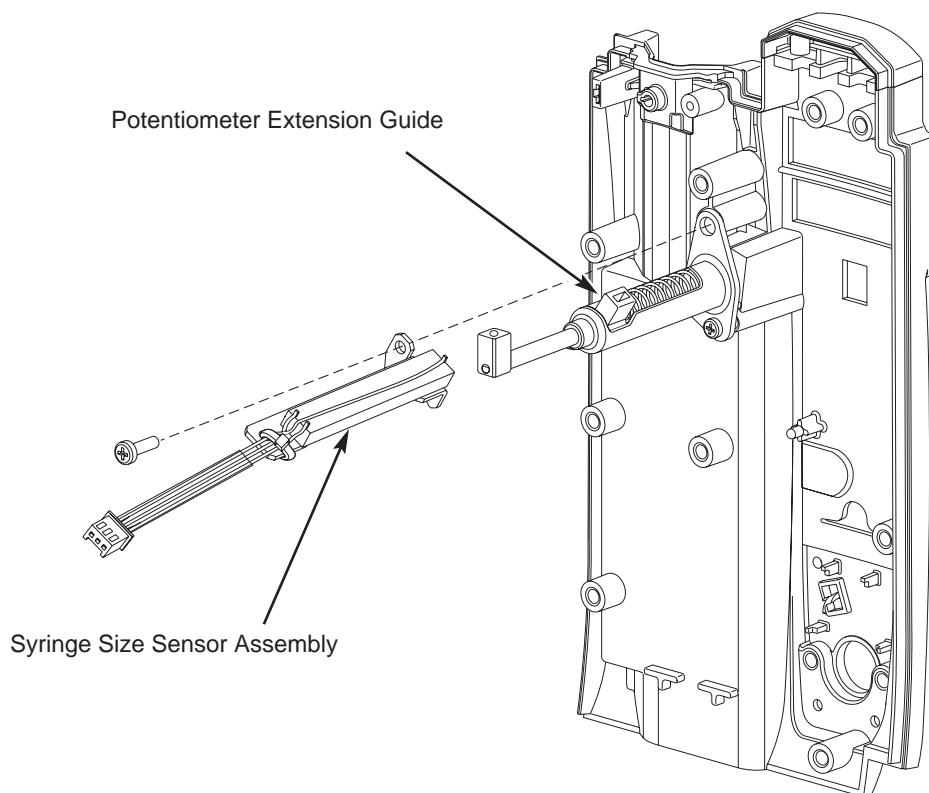
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.14 Removing Syringe Size Sensor Assembly

1. Remove one (1) screw attaching Syringe Size Sensor Assembly and Shaft Support to Front Case.
2. Remove Syringe Size Sensor Assembly.

#### During Reassembly:

1. Insert tab on Syringe Size Sensor Assembly into Potentiometer Extension Guide.
2. Secure Syringe Size Sensor Assembly to Front Case.



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.15 Removing Syringe Barrel Clamp Assembly

#### CAUTION

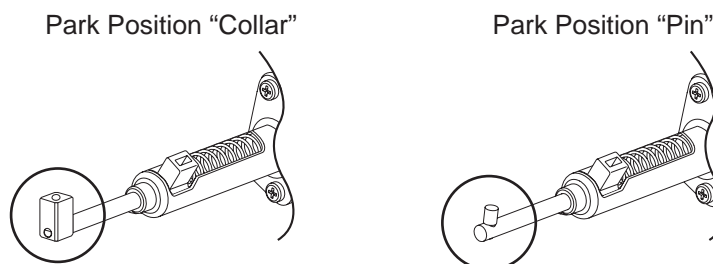
To replace a Syringe Barrel Clamp Assembly with a park position “pin” (rather than a “collar”), replace with Front Case Assembly Kit (Table 7A-1, item 9).

1. Loosen set screw securing park position collar to Barrel Clamp and remove collar.
2. Remove Potentiometer Extension Guide.
3. Remove one (1) screw attaching Shaft Support to Front Case.
4. Remove Retaining Rings, Compression Spring, Bushing and Barrel Clamp.

#### During Reassembly:

1. If Shaft Seal has been removed:
  - a. Reinstall with wide lip facing Front Case.
  - b. Use a #2 flat-bladed screwdriver to carefully push around edges of seal until it is fully seated into Front Case recess.
  - c. Verify seal is completely seated by slowly pulling Barrel Clamp out  $\frac{1}{2}$  to 1 inch and then slowly pushing it back in, ensuring seal does not move out of recess.
2. Potentiometer Extension Guide:
  - a. Fully retract Barrel Clamp (seat against Front Case).
  - b. Insert Potentiometer Extension Guide through Shaft Support and “snap” into place on shaft.
3. Tighten park position collar setscrew against flat on end of shaft.

#### -- Barrel Clamp Assembly (Partial View) --



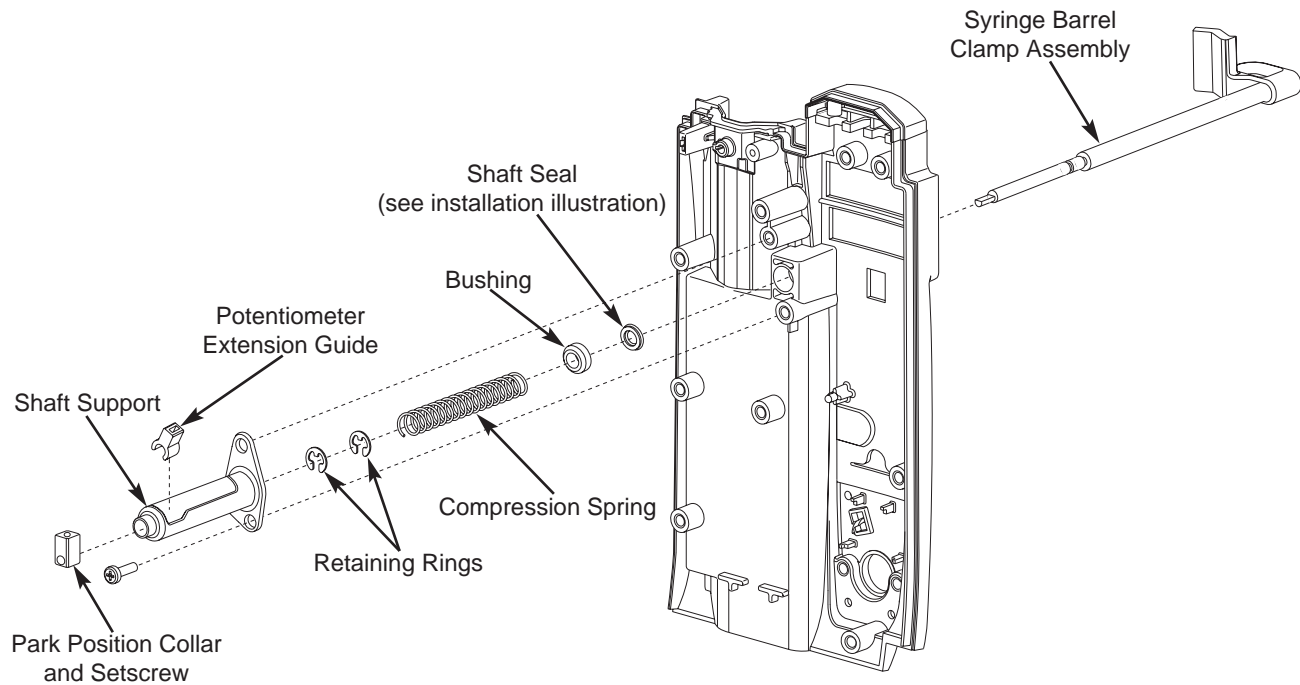
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## CORRECTIVE MAINTENANCE

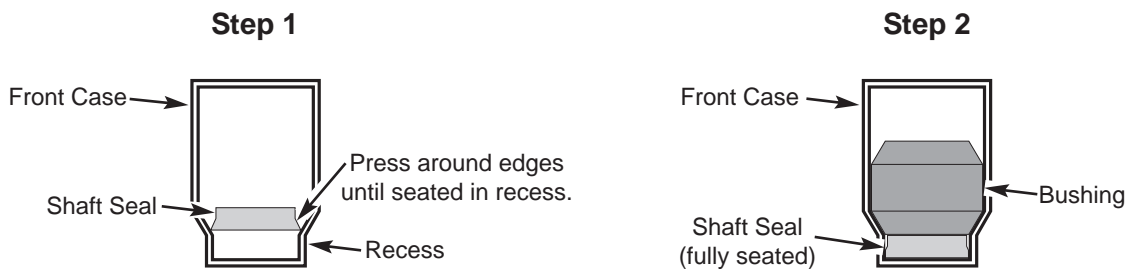
### Syringe Module

## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.15 Removing Syringe Barrel Clamp Assembly (Continued)



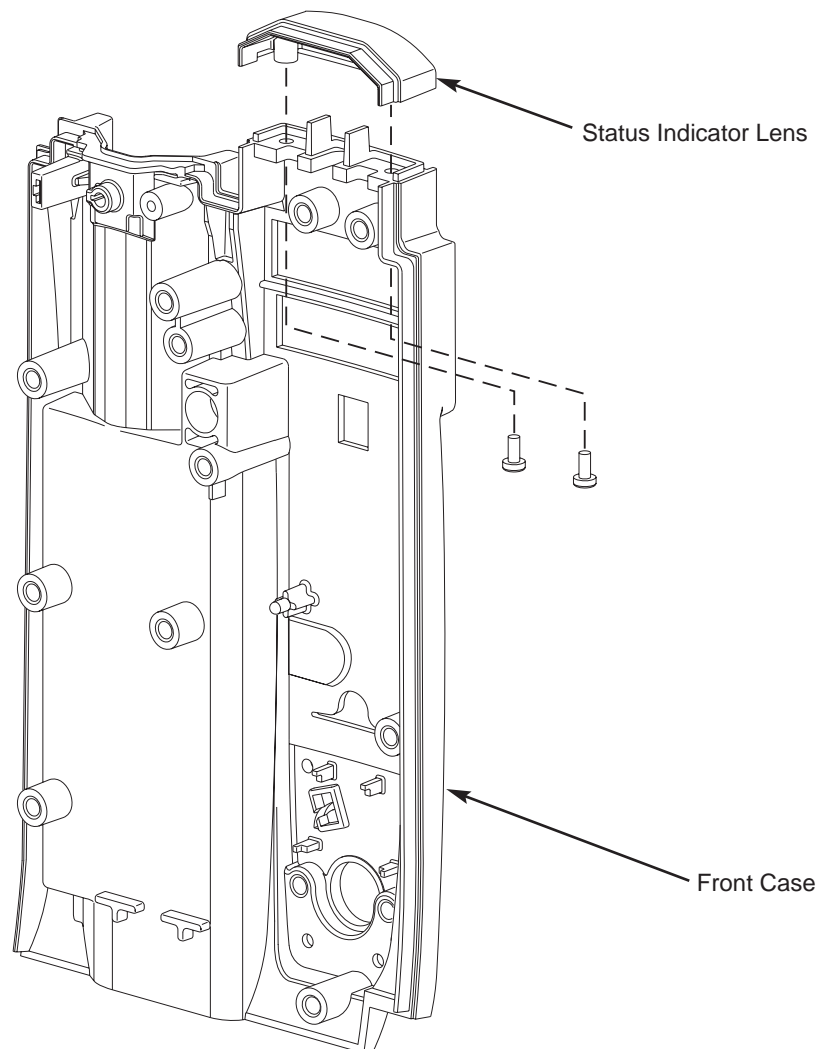
### Shaft Seal Installation



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.16 Removing Status Indicator Lens

1. Remove two (2) screws attaching Status Indicator Lens to Front Case.
2. Remove Status Indicator Lens.



## CORRECTIVE MAINTENANCE

### Syringe Module

## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.17 Removing Housing Assembly and Guide Rod

#### CAUTION

Use EXTREME CAUTION when removing Housing Assembly. If the Conductive Wiper is damaged, replace the entire Lower Housing/Carriage Assembly.

**NOTE:** If the Housing Assembly must be replaced on a Syringe Module with version 7 or earlier software, the Housing Assembly must be replaced at the depot. See the note at the beginning of this chapter for more information.

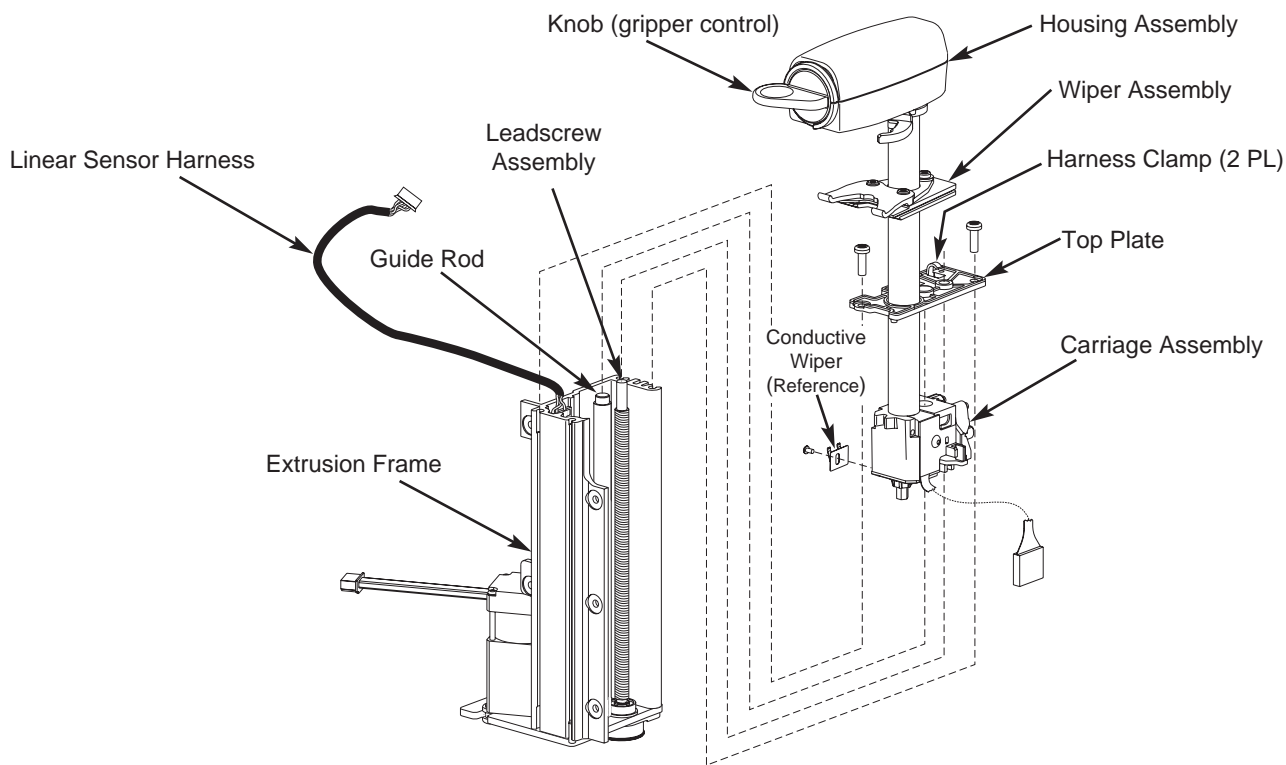
1. Pull Linear Sensor Harness loose from clamps on Top Plate.
2. Remove two (2) screws attaching Top Plate to Extrusion Frame.

3. Gently place assembly in a standing position and orient it with motor facing inward.

#### CAUTION

When performing the next step, use care to avoid damaging the leadscrew pulley.

4. Rotate knob (gripper control) to disengage plunger grippers and slowly raise Housing Assembly until Carriage Assembly nears top of Extrusion Frame.
5. Angle Housing Assembly away from Linear Sensor Assembly so that Conductive Wiper does not contact Linear Sensor.
6. Gently remove Housing Assembly.
7. Lift Guide Rod from Bottom Plate and remove.



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.18 Removing Motor/Pulley Assembly

1. Remove four (4) screws attaching Motor/Pulley Assembly to Bottom Plate.
2. Remove Motor Belt.
3. Remove Motor/Pulley Assembly.

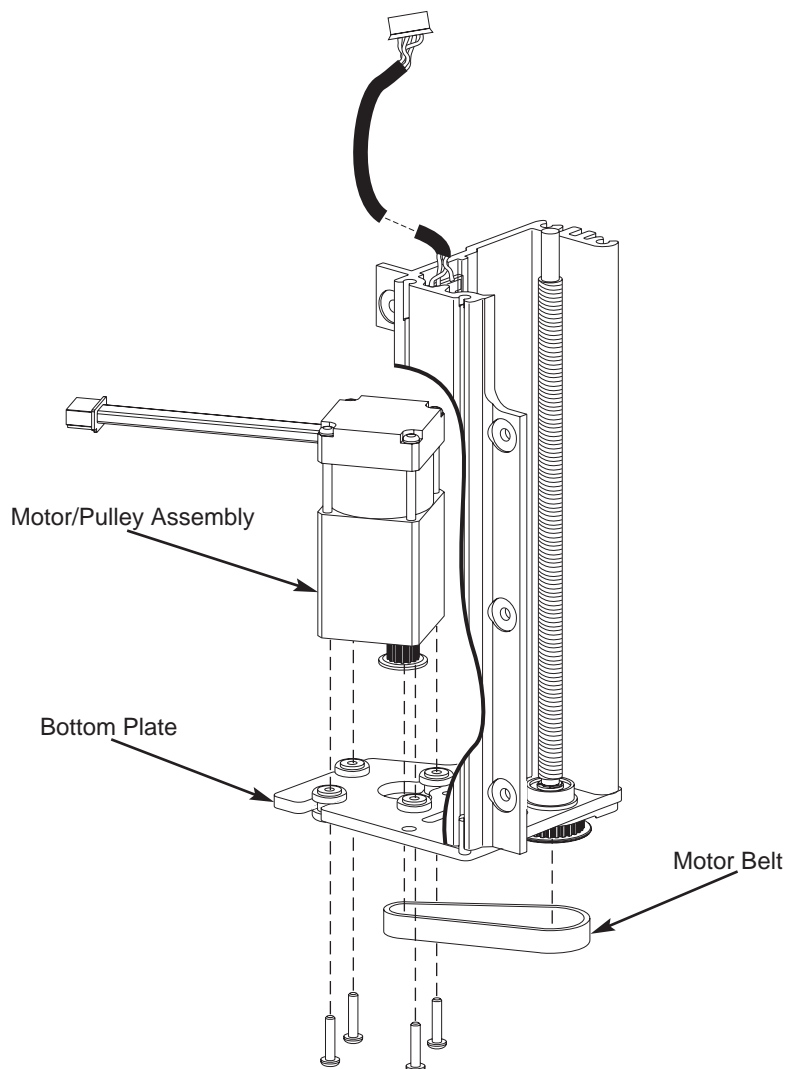
#### During Reassembly:

1. To prevent pinion damage, install Motor/Pulley Assembly through Bottom Plate at a slight angle.

### 2. Install Motor Belt:

- a. Install wide end of belt onto leadscrew pulley.
- b. Tilt Motor/Pulley Assembly and install other end of belt onto motor pulley. Do not stretch belt to fit over pulley.

### 3. Screw Motor/Pulley Assembly in place.



## CORRECTIVE MAINTENANCE

### Syringe Module

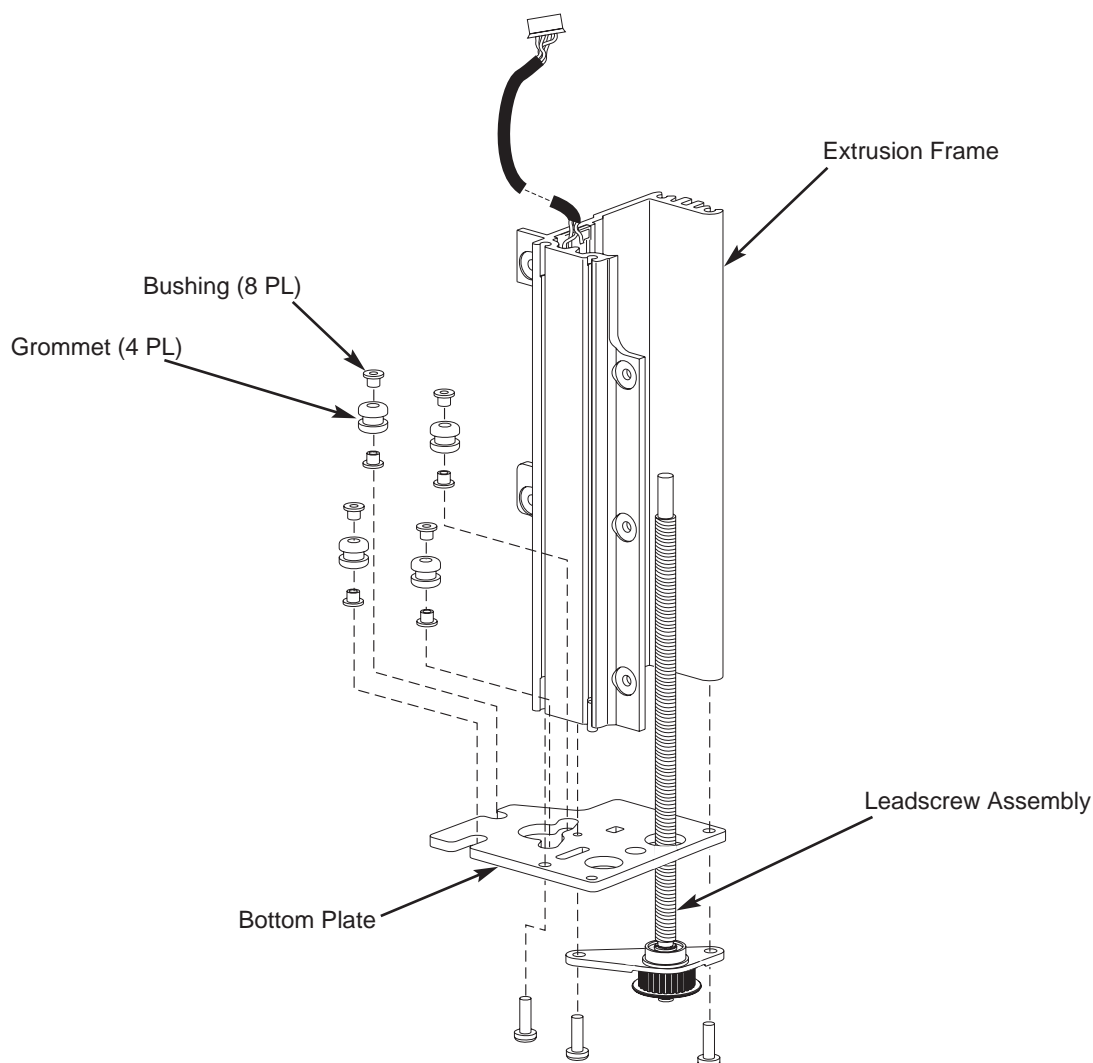
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.19 Removing Leadscrew Assembly and Bottom Plate

1. Remove two (2) screws attaching Leadscrew Assembly to Bottom Plate.
2. Remove Leadscrew Assembly.
3. Remove remaining screw attaching Bottom Plate to Extrusion Frame.
4. Remove Bottom Plate.

#### During Reassembly:

If replacing Bottom Plate, remove bushings and grommets from old plate and install into new plate.





## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.20 Removing Linear Sensor Assembly

#### CAUTION

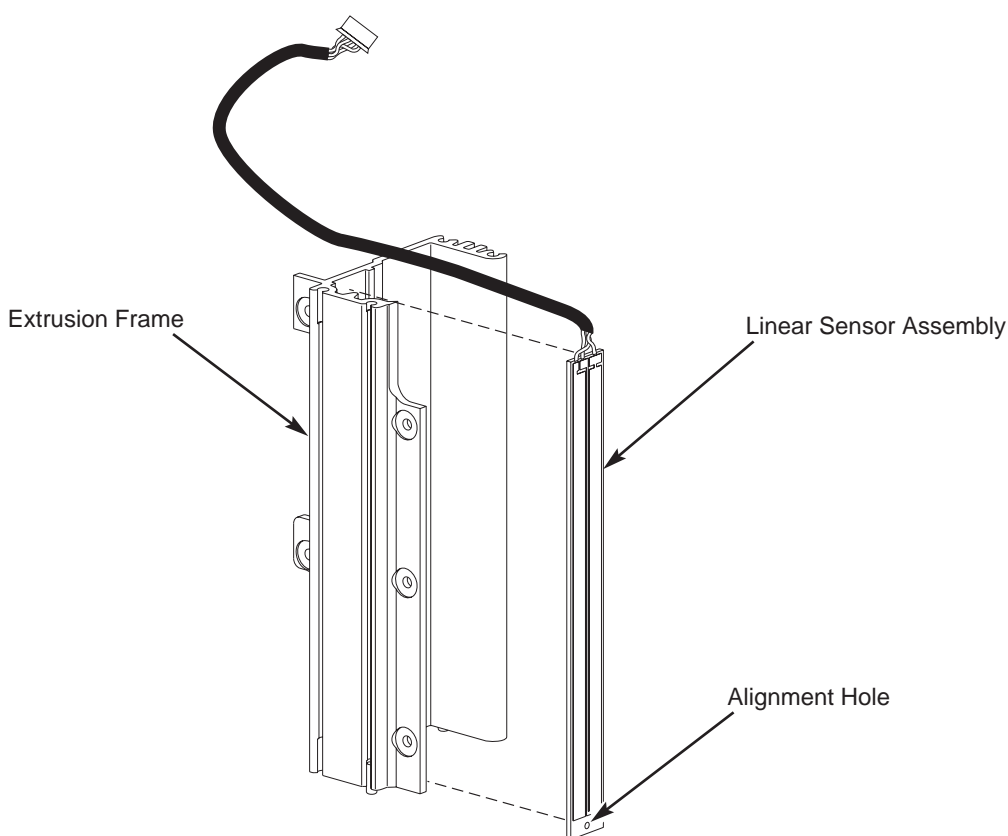
To avoid damaging the Linear Sensor Assembly, do not touch with bare hands.

1. Peel Linear Sensor Assembly off Extrusion Frame.
2. Use alcohol to clean adhesive debris from Extrusion Frame.

#### During Reassembly:

1. Ensure Extrusion Frame surface is clean.

2. Before adhering Linear Sensor Assembly to Extrusion Frame:
  - a. Remove protective backing from Linear Sensor.
  - b. Align hole in Linear Sensor Assembly with hole in Extrusion Frame.
3. Use a burnishing tool to ensure that Linear Sensor Assembly is securely adhered to Extrusion Frame.
4. Clean Linear Sensor Assembly surface using alcohol and lint-free cloth (such as Kimwipes or lint-free tissue).



## CORRECTIVE MAINTENANCE

### Syringe Module

## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.21 Removing Force Sensor and Actuator Knob Assemblies

**NOTE:** If the Force Sensor Assembly must be replaced on a Syringe Module with version 7 or earlier software, the Force Sensor Assembly must be replaced at the depot. See the note at the beginning of this chapter for more information.

1. Loosen four (4) screws attaching Upper Housing to Lower Housing just far enough to remove Upper Housing, leaving O-Rings attached to screws.

**NOTE:** To avoid losing O-Rings, push each screw upward to grab and hold its O-Ring before removing screws from Upper Housing.

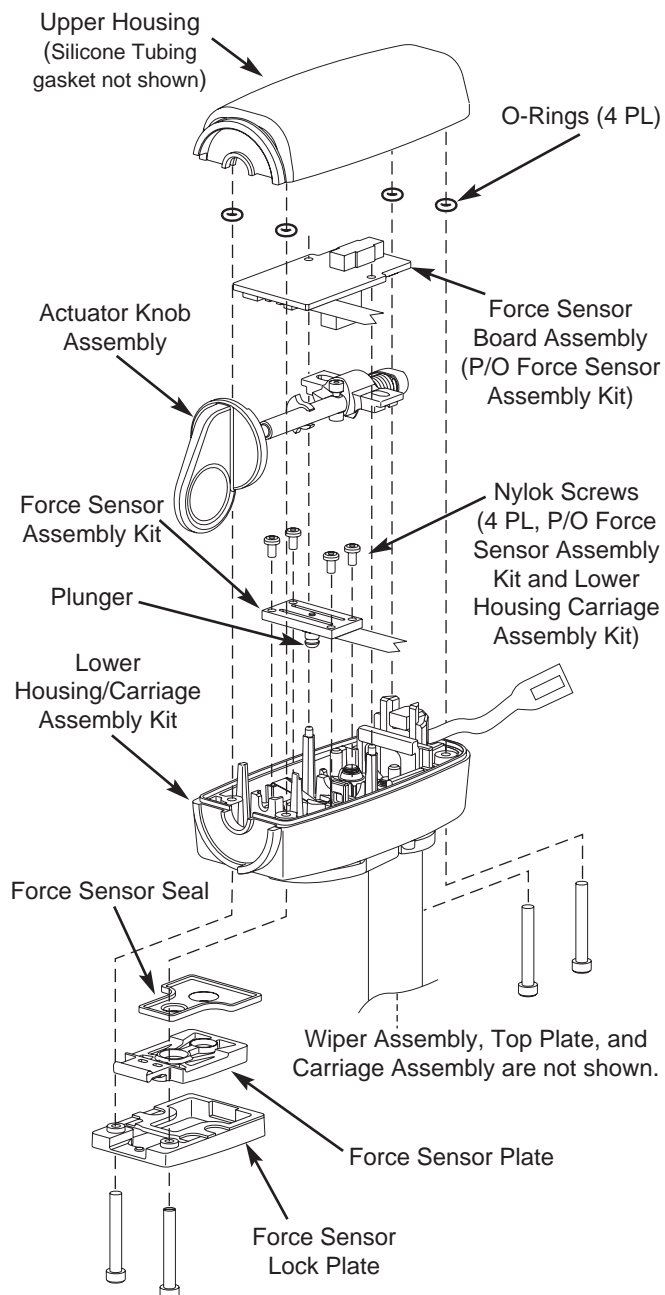
2. Disconnect flex cable from Force Sensor Board J1.
3. Lift Force Sensor Board off mounting posts.
4. Remove Actuator Knob Assembly.
5. Remove four (4) screws attaching Force Sensor Assembly to Lower Housing.
6. Remove Force Sensor Assembly.
7. Remove Force Sensor Lock Plate, Force Sensor Plate, Force Sensor Seal and Upper Housing.

**During Reassembly:** (see Figure 7A-1)

- Ensure Silicone Tubing gasket in Upper Housing is undamaged and is in place.
- Ensure Plunger Flag (part of Lower Housing Assembly) and Force Sensor Assembly plunger are seated in Force Sensor Seal.
- Ensure Force Sensor Assembly flex cable is tucked inside upper and lower housings.

### CAUTION

To avoid damaging Lower Housing, use Nylok screws to install Force Sensor Assembly.



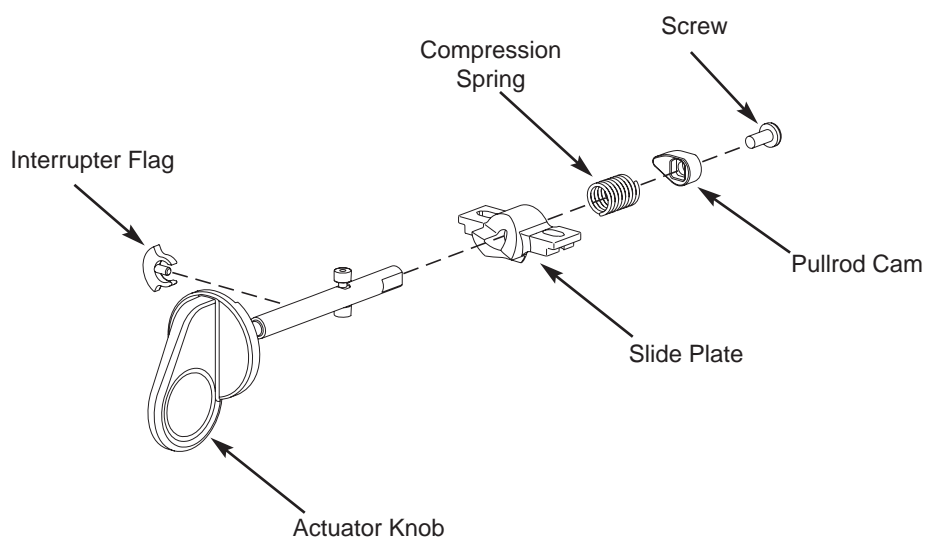
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.22 Removing Actuator Knob Assembly Parts

1. Use a small pair of needle-nose pliers to gently pull Interrupter Flag from Actuator Knob Assembly.
2. Remove screw to remove Slide Plate, Compression Spring, and Pullrod Cam.

#### During Reassembly:

- Install Slide Plate and Compression Spring onto Actuator Knob, compress Spring with Pullrod Cam, then install screw.



## CORRECTIVE MAINTENANCE

### Syringe Module

**Table 5A-2. Torque Values - Syringe Module**

Functional Application	Item Description	Torque Value
DRIVETRAIN ASSEMBLY		
Bottom Plate	6-32 x $\frac{7}{16}$	12 in-lb
Leadscrew Assembly	6-32 x $\frac{7}{16}$	12 in-lb
Motor/Pulley Assembly	M2.5 x 12	4 in-lb
Top Plate	6-32 x $\frac{7}{16}$	6 in-lb
FINAL ASSEMBLY		
Handle Assembly	4-40 x $\frac{3}{4}$	6 in-lb
IUI Connectors	6-32 x $\frac{7}{16}$	12 in-lb
Latch Assembly	4-40 x $\frac{5}{16}$	6 in-lb
Rear Case - Front Case	4-40 x $\frac{5}{16}$	6 in-lb
Rear Case - Internal Frame	6-32 x $\frac{7}{16}$	12 in-lb
FRONT CASE ASSEMBLY		
Disk Holder, Base - Disk Holder	4-40 x $\frac{5}{16}$	6 in-lb
Disk Holder, Base - Front Case	4-40 x $\frac{1}{4}$	6 in-lb
Disk Holder, Top	4-40 x $\frac{3}{16}$	6 in-lb
Drivetrain Assembly - Front Case	4-40 x $\frac{5}{16}$	6 in-lb
Internal Frame - Drivetrain Assembly	6-32 x $\frac{5}{16}$	12 in-lb
Internal Frame - Front Case	4-40 x $\frac{5}{16}$	6 in-lb
IUI Support Bracket	6-32 x $\frac{5}{16}$	12 in-lb
Logic Board Assembly	4-40 x $\frac{5}{16}$	6 in-lb
Park Position Collar	setscrew - <u>no</u> nylon patch	6 in-lb
	setscrew - <u>with</u> nylon patch	10 in-lb
Sensor Board Assembly	4-20 x $\frac{5}{16}$	6 in-lb
Status Indicator Lens	4-20 x $\frac{5}{16}$	6 in-lb
Syringe Barrel Clamp Assembly	4-40 x $\frac{5}{16}$	6 in-lb
Syringe Size Sensor Assembly	4-40 x $\frac{5}{16}$	6 in-lb
HOUSING / CARRIAGE ASSEMBLY		
Actuator Knob Assembly	4-40 x $\frac{1}{4}$	6 in-lb
Force Sensor Assembly	2-56 x $\frac{3}{16}$	6 in-lb
Upper - Lower Housing	4-20 x 1	8 in-lb

**Table 5A-3. Level of Testing Guidelines - Syringe Module**

Tests to Perform →

● = Required  
X = If verification fails.  
Blank = Not Applicable

Repair/Replacement of: ↓

	Alarm Test	Barrel Size Accuracy Verification	Barrel Size Calibration	Binary Switches Test	Channel ID/UI Connector Test	Keypad Test	Plunger Force Accuracy Verification	Plunger Force Sensor Calibration	Plunger Position Accuracy Verification	Plunger Position Calibration	Pressure Disc Accuracy Verification	Pressure Disc/Sensor Calibration	Simultaneous Display Test	Visual/Instrument Inspection
Actuator Knob Assy.				●			●	X	●	X				●
Disc Holder, Top / Base				●										●
Display Board Assy.	●				●	●							●	●
Drivetrain Assy.				●	●		●	X	●	●				●
Force Sensor Assy.				●			●	●	●	X				●
Front Case		●	X		●	●					●	X	●	●
Handle Assy.														●
Housing/Carriage Assy., Lower				●	●		●	X	●	●				●
Housing Assy., Complete				●	●		●	X	●	X				●
Internal Frame Assy.					●									●
IUI Board Assy.		●	X		●		●	X	●	X				●
IUI Connector Assy.					●									●
Latch Assy.														●
Leadscrew Assy.					●		●	X	●	X				●
Logic Board Assy.		●	●		●		●	●	●	●	●	●		●
Pressure Sensor Board Assy.				●	●						●	●		●
Rear Case					●									●
Sensor Board Assy.				●	●		●	X	●	X				●
Status Indicator Lens	●				●								●	●
Syringe Barrel Clamp assy.		●	●	●	●									
Syringe Size Sensor Assy.		●	●	●	●									●

-- Continued Next Page --

## CORRECTIVE MAINTENANCE

Syringe Module

**Table 5A-3. Level of Testing Guidelines - Syringe Module (Continued)**

Tests to Perform →	Alarm Test	Barrel Size Accuracy Verification	Barrel Size Calibration	Binary Switches Test	Channel ID/UI Connector Test	Keypad Test	Plunger Force Accuracy Verification	Plunger Force Sensor Calibration	Plunger Position Accuracy Verification	Plunger Position Calibration	Pressure Disc Accuracy Verification	Pressure Disc/Sensor Calibration	Simultaneous Display Test	Visual/Instrument Inspection
● = Required X = If verification fails. Blank = Not Applicable														
Repair/Replacement of: ↓														
Miscellaneous: ↓														
Instrument Dropped	●	●		●	●	●	●		●		●		●	●
Instrument Software Flashed														●
New Instrument Checkout	●	●		●	●	●	●		●		●		●	●
No Fault Found (instrument not opened)	●			●	●	●							●	●
No Fault Found (instrument opened)	●	●		●	●	●	●		●		●		●	●

### NOTES:

- Use the Maintenance Software to perform testing and calibration.
- After performing any calibration procedure, always perform the associated verification test.







## Chapter 5B — CORRECTIVE MAINTENANCE

PCA Module

### WARNING

Disconnect the instrument from the Alaris® System before performing maintenance. Only qualified personnel using proper grounding techniques should open the instrument case.

### CAUTION

CMOS devices are sensitive to static electrical charges and may be damaged during repair if the repair activity is not performed in an electrostatic discharge (ESD) protected environment using approved ESD protective procedures, including personnel grounding.

**NOTE:** Due to product changes over time, components/assemblies illustrated in this chapter may differ from the disassembled instrument. If there are any questions, contact Cardinal Health Technical Support.

### 5.1 INTRODUCTION

This chapter describes how to disassemble and reassemble the PCA Module.

For more efficient repair, read the “Principles of Operation” chapter for information on the mechanical and electrical functions of the PCA Module.

The surface mount devices on the circuit boards are not field repairable. Return circuit boards to an authorized Cardinal Health Service Center for repair. Attempting circuit board repairs voids all warranties.

Whenever the PCA Module is repaired, perform the minimum tests required for new instrument checkout using Maintenance Software.

For information on replacement parts, see the “Illustrated Parts Breakdown” chapter.

Following any level of maintenance, perform the applicable tests (refer to “Level of Testing Guidelines” table).

## CORRECTIVE MAINTENANCE

### PCA Module

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## 5.2 DISASSEMBLY/REASSEMBLY

Follow these procedures in order for the most efficient disassembly of PCA Module subassemblies. To reassemble the PCA Module, reverse the disassembly steps.

### CAUTION

Disconnect the PCA Module from the Alaris® System before attempting disassembly.

**NOTE:** Perform all maintenance on an antistatic surface, preferably a grounded antistatic mat.

Before adhering gaskets and labels to the instrument, clean the surface with a cotton swab or soft cloth lightly dampened with 70% Isopropyl Alcohol.

### CAUTION

To avoid the risk of electrical hazard or damage to the instrument circuitry, do not spray fluids directly onto the instrument or allow fluids to enter the instrument.

**Table 5B-1. Required Materials, Supplies and Tools - PCA Module**

**NOTE:** Contact/source information is subject to change.

- Silicone grease, Dow Corning Molykote 33, or equivalent (<http://www.dowcorning.com>)
- #1 Phillips screwdriver
- #2 Phillips screwdriver
- Small diagonal cutters
- Lint-free cloth (such as, Kimwipes or lint-free tissue)

The following items are available from TECHNI-TOOL (800.832.4866; <http://www.techni-tool.com>).

- Hex Head Bit,  $\frac{1}{16}$  HX,  $1\frac{15}{16}$ " Length, TT #758SC0172 (used for 0.062" Park Position Collar Setscrew)
- Power bit, ball hex  $\frac{5}{64}$ ,  $\frac{1}{4}$  HX,  $3\frac{1}{2}$ " length, TT #758SC0172
- Power bit, ball hex  $\frac{3}{32}$ ,  $\frac{1}{4}$  HX,  $3\frac{1}{2}$ " length, TT #758SC0173
- Tamper-resistant Torx bit, size T8,  $1\frac{15}{16}$ " length, TT #758SC0321
- Torque screwdriver with a minimum range of 3-15 in-lbs. Recommend torque screwdriver, Micro-Adjustable, TT #844SC5002 or TT #304TO034.
- Torque wrench with a minimum range of 40 in-lbs. Recommend  $\frac{1}{4}$  torque wrench #155IE150.
- Torx Bit, Size T6,  $1\frac{15}{16}$ " Length, TT #758SC0301

The following items may be purchased from McMaster-Carr (562.692.5911; <http://www.mcmaster.com>).

- Insert-bit holder,  $\frac{1}{4}$ " hex drive, 6" length, #7225A42
- $\frac{1}{4}$ " drive  $\frac{9}{16}$ " deep-well socket (available at any hardware or tool store)
- Slotted screwdriver,  $\frac{1}{8}$ " tip width, 3" length blade, #5682A37
- Insert-Bit, 0.05" Hex Size,  $\frac{1}{4}$ " Hex Shank, 1" Length, #8526A46 (used for 0.05" Park Position Collar Setscrew)

## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.1 Removing Latch Assembly and Feet

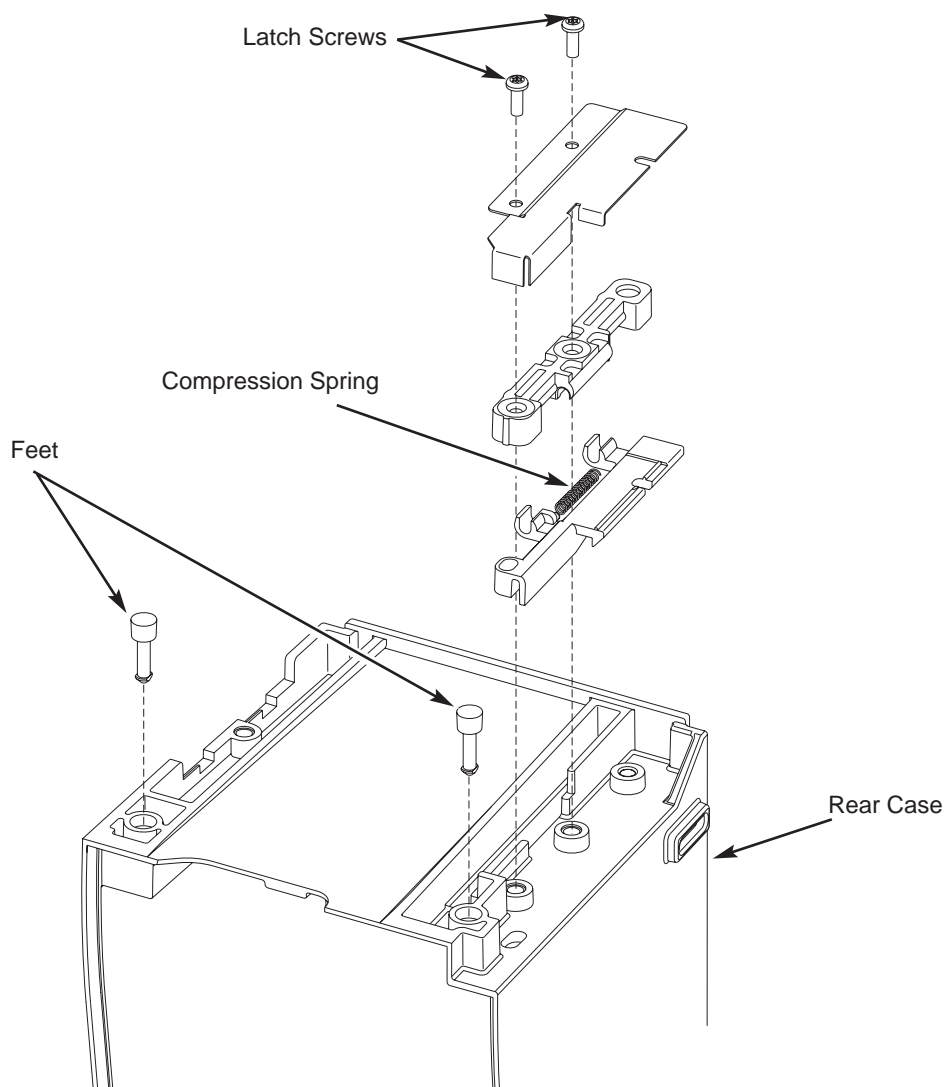
1. Remove two (2) screws attaching Latch Assembly to bottom of Rear Case and remove Latch Assembly components.
2. Pull two (2) Feet from underside of module.

**NOTE:** When reinstalling the Compression Spring, be sure to orient as shown during reassembly.

#### During Reassembly:

- When reinstalling Latch Assembly, press toward outer edge of module and screw into position.
- Apply thin layer of Dow Corning Molykote 33 (or equivalent) silicone grease to Feet.

**NOTE:** The Feet press-fit into the module.



## CORRECTIVE MAINTENANCE

PCA Module

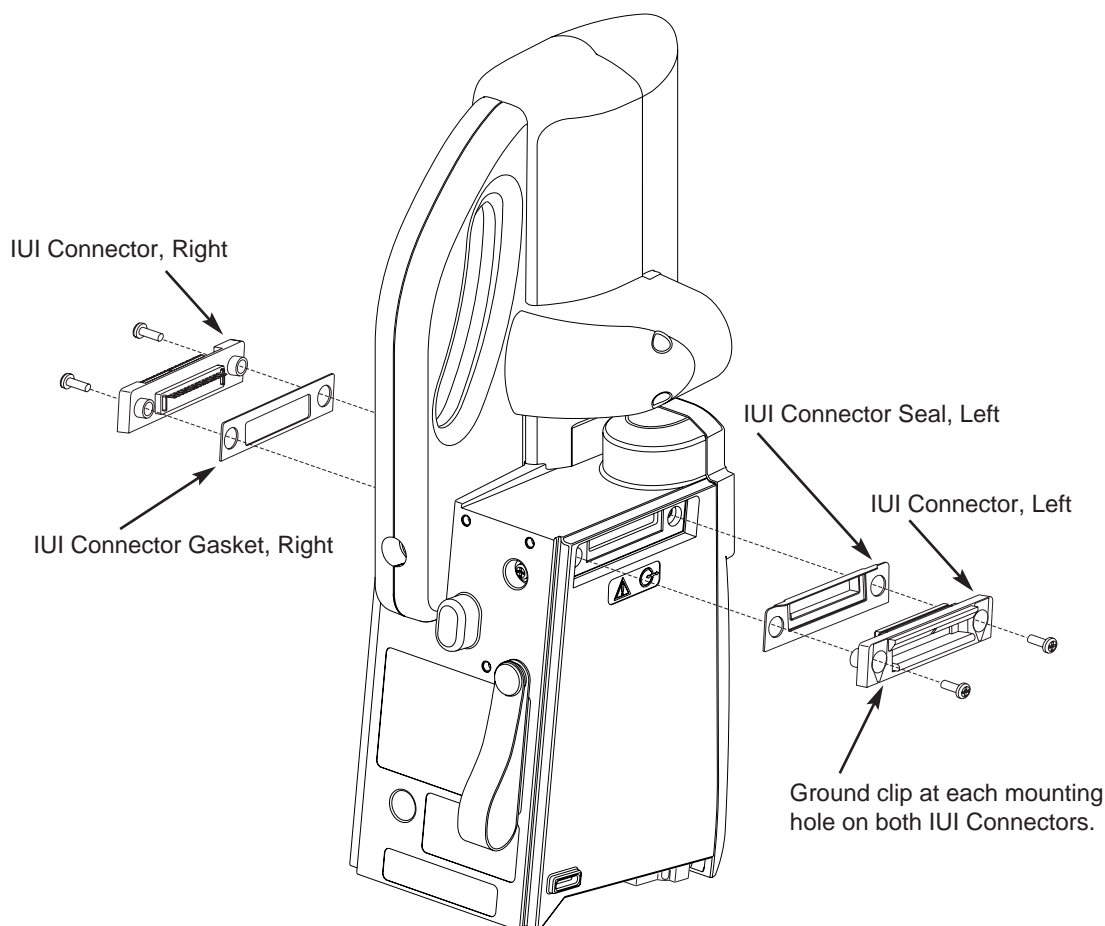
### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

#### 5.2.2 Removing IUI Connector Assemblies

Remove two (2) screws attaching each IUI (left and right) to module.

##### During Reassembly:

- Ensure ground clips are still installed on both IUI connectors.
- To install Right IUI Connector Gasket, remove protective backing and adhere to IUI Connector.
- To install Left IUI Connector Seal, position seal on one end of connector and stretch to other end to conform to connector body. Gently press on seal to seat completely. Use lint-free swab to apply alcohol to top, sides, and bottom of seal for lubrication while installing to Rear Case. Do not apply alcohol to contacts or connector.



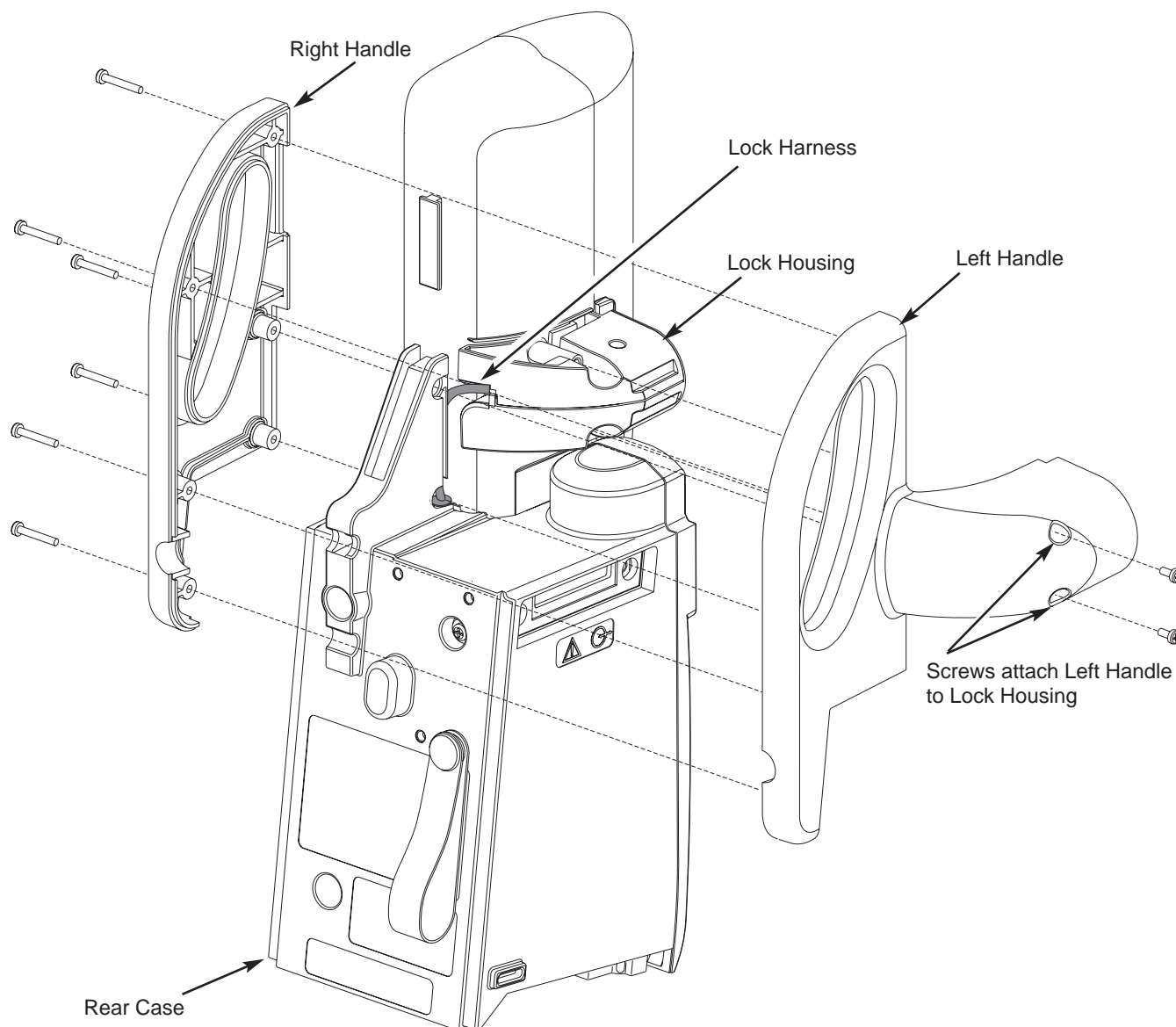
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.3 Removing Handle

1. Remove six (6) screws attaching Left and Right Handles.
2. Remove two (2) screws attaching Left Handle to Lock Housing.
3. Detach Left and Right Handles from each other and module.

#### During Reassembly:

- Assemble Left Handle over Lock Housing and ensure that Lock Harness is routed under Lock Housing boss.
- Use two (2) screws to attach Left Handle to Lock Housing.
- Install Right Handle over Left Handle and secure with six (6) screws.



## CORRECTIVE MAINTENANCE

PCA Module

### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

#### 5.2.4 Removing Door Assembly

1. Remove four (4) T8 Torx Security screws and four (4) Hinge Bushings attaching Door Assembly to right side of Front Case.
2. Unlock Door, and lift Lock Assembly away from Door. Take care not to pull on Lock Assembly harness.
3. Remove Door Assembly.

##### *Disassembling Door Assembly:*

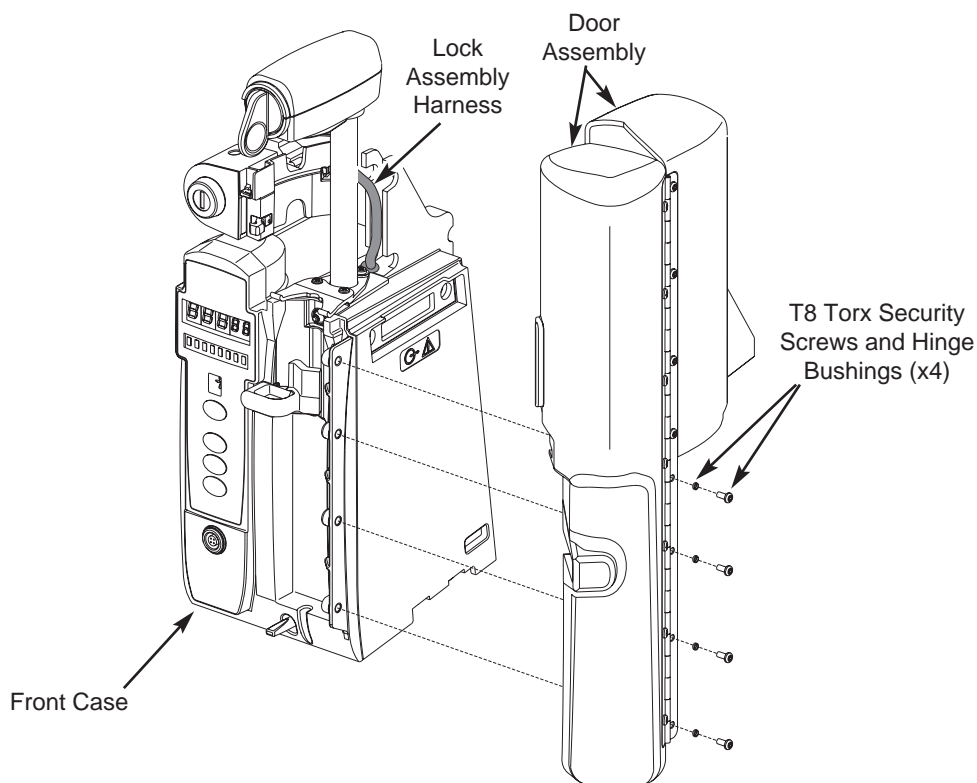
4. Remove four (4) screws attaching Front Door, Rear Door Lockplate, and Rear Door.
5. Remove seven (7) screws attaching Hinge to Front Door and Lockplate.

6. Remove two (2) screws attaching Lockplate and Strikeplate Lockplate to Front Door.

##### **During Reassembly:**

##### *Reassembling Door Assembly:*

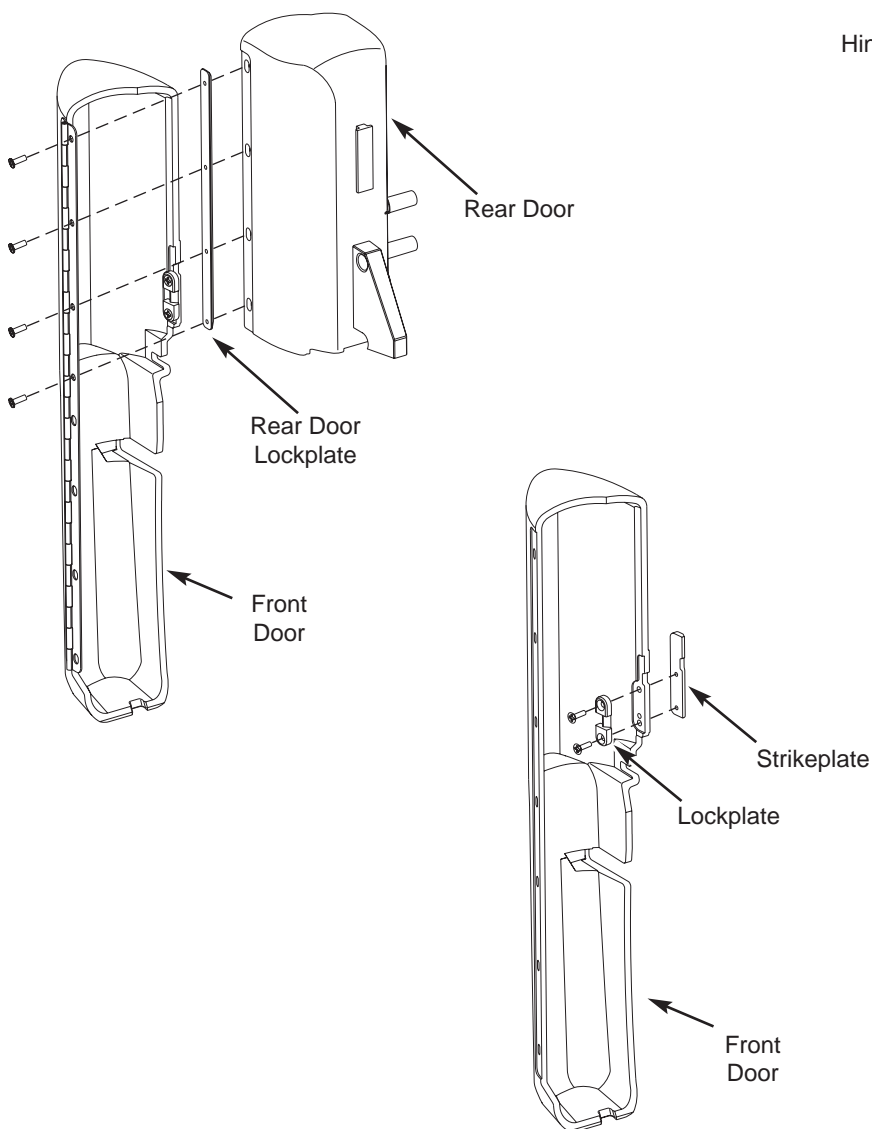
1. Use two (2) screws to assemble Door Strikeplate to Front Door.
2. From inside of Door, align Front Door Lockplate holes with through-holes on Door. From outside of Door, align holes on hinge with those on Door and Front Door Lockplate. Install but only loosely tighten seven (7) screws to attach hinge.



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

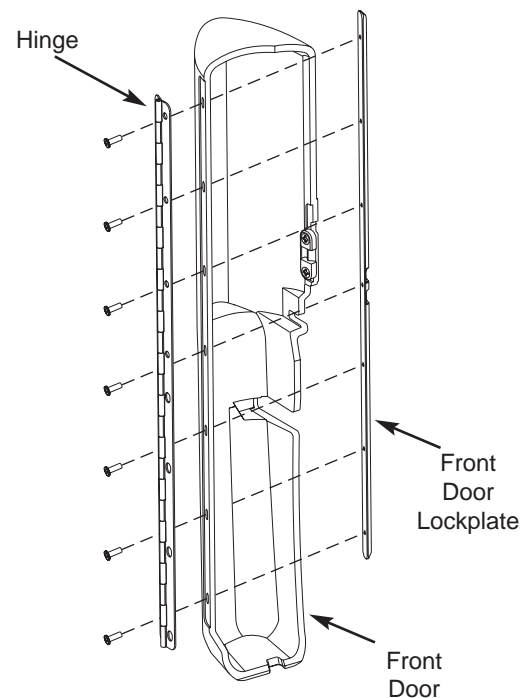
### 5.2.4 Removing Door Assembly (Continued)

3. Align Rear Door Lockplate to inside of Rear Door. Install but only loosely tighten four (4) screws on upper section of hinge.



### Reinstalling Door Assembly:

4. Install four (4) Hinge Bushings into four (4) slots on lower section of hinge.
5. Install but only loosely tighten four (4) T8 Torx Security screws.
6. Close Door in Lock position and align Door edges (front and back doors flush), then tighten all screws.



## CORRECTIVE MAINTENANCE

PCA Module

### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

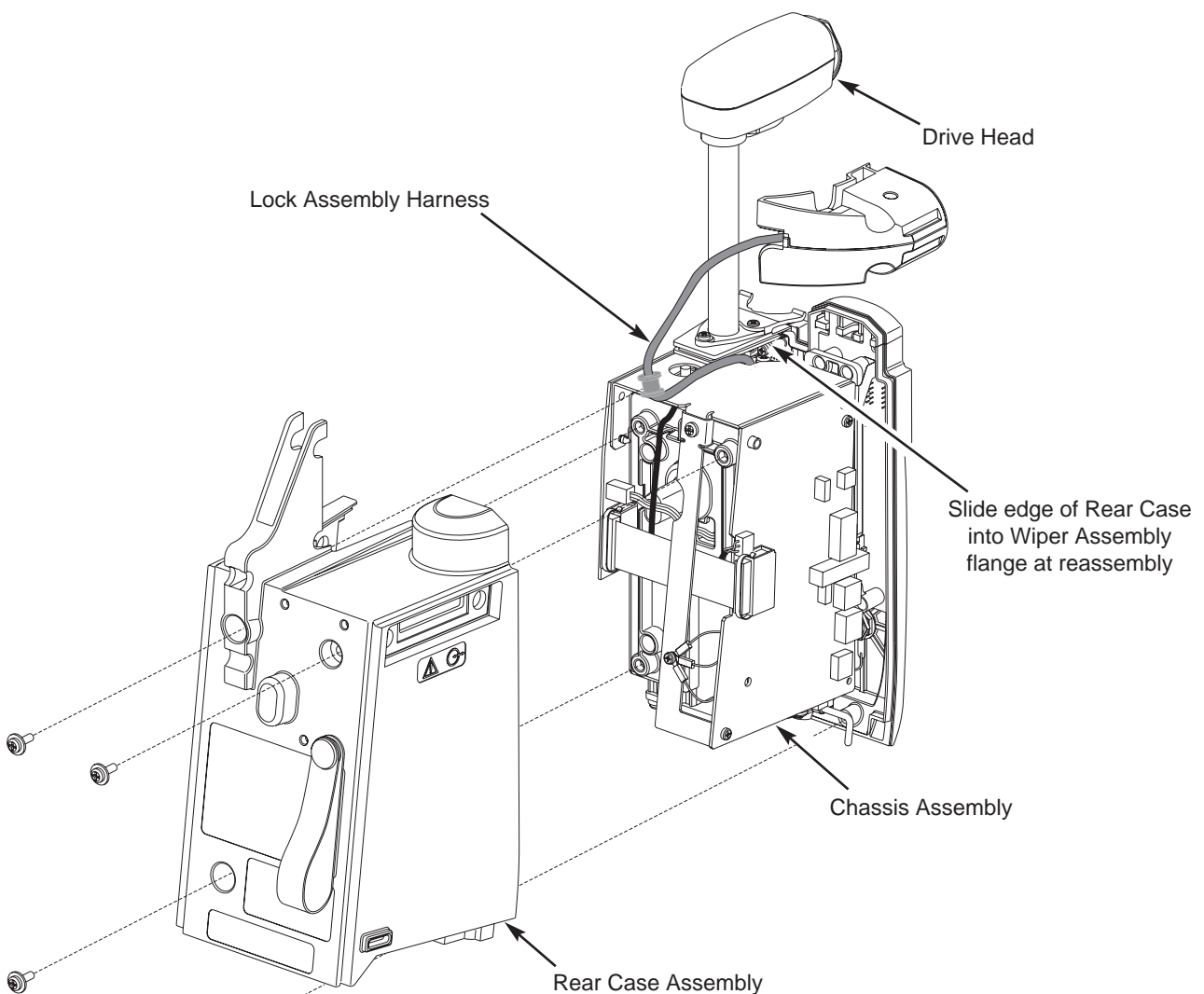
#### 5.2.5 Removing Rear Case

1. Remove four (4) screws (and associated washers) attaching Rear Case to chassis assembly.
2. Pull Rear Case away from chassis assembly.

##### During Reassembly:

- Ensure that Silicone Tubing gasket in Rear Case is in place and undamaged (see Figure 7B-10).

- Raise Drive Head to highest position before sliding Chassis Assembly into Rear Case.
- Slide edges of Rear Case into Wiper Assembly flange.
- Route Lock Assembly harness along flange on Rear Case.





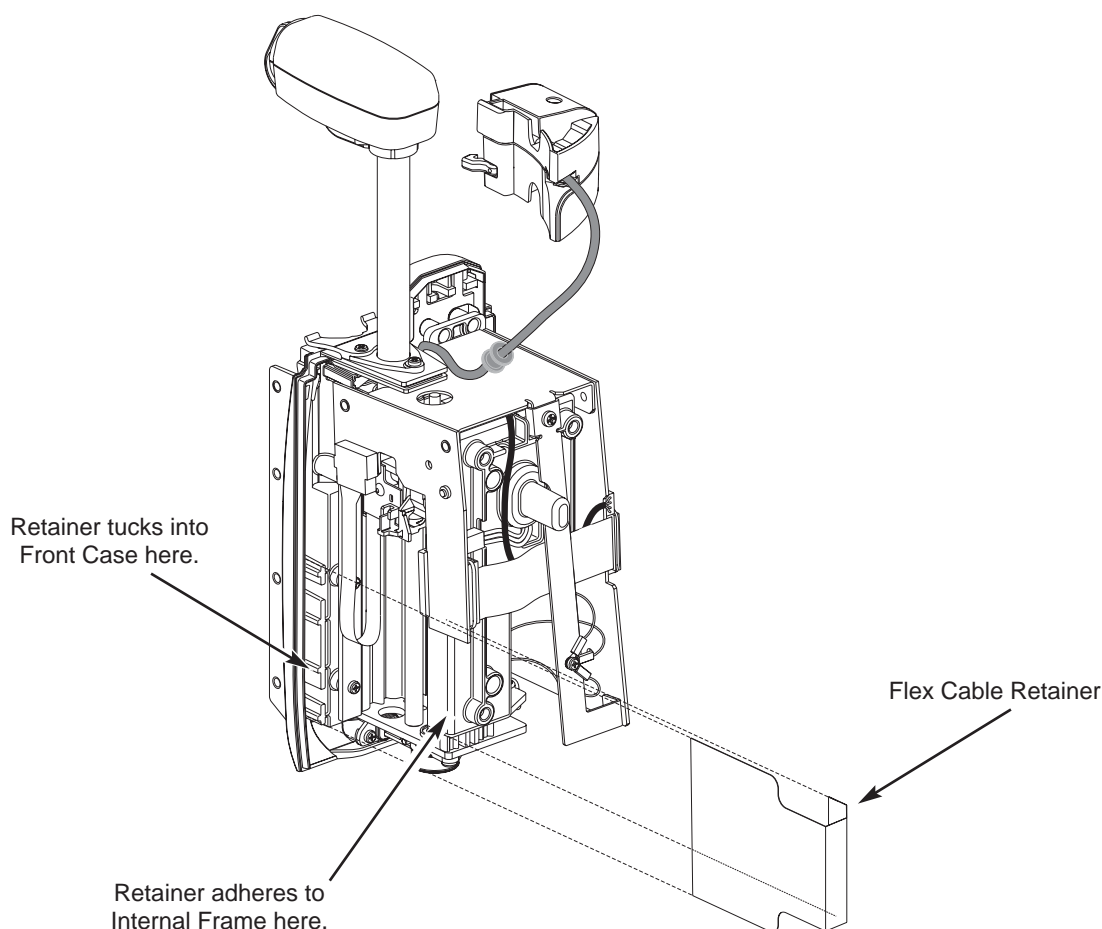
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.6 Removing Flex Cable Retainer

1. Peel Flex Cable Retainer from Internal Frame.
2. Use a cotton swab or soft cloth lightly dampened with 70% Isopropyl Alcohol to remove adhesive debris from Internal Frame.

### During Reassembly: (see Figure 7B-9)

1. Ensure Internal Frame surface (where retainer is adhered) is clean and free of adhesive debris.
2. Remove protective backing from replacement retainer and adhere to Internal Frame.
3. If necessary, bend retainer on each fold line at a 90° angle, toward front of instrument.
4. Lay retainer over Flex Cable and tuck inside Front Case.



## CORRECTIVE MAINTENANCE

PCA Module

### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

#### 5.2.7 Removing IUI Board Assembly

1. If present, remove Retainer Clip from Dual Connector Cable-IUI Board connection.
2. Disconnect Dual Connector Cable from IUI Board J2.
3. Disconnect Syringe Size Sensor harness from IUI Board J4.
4. Disconnect Flex Cable from IUI Board J3.

5. Use small diagonal cutters to lift and remove snap rivet from IUI Board.

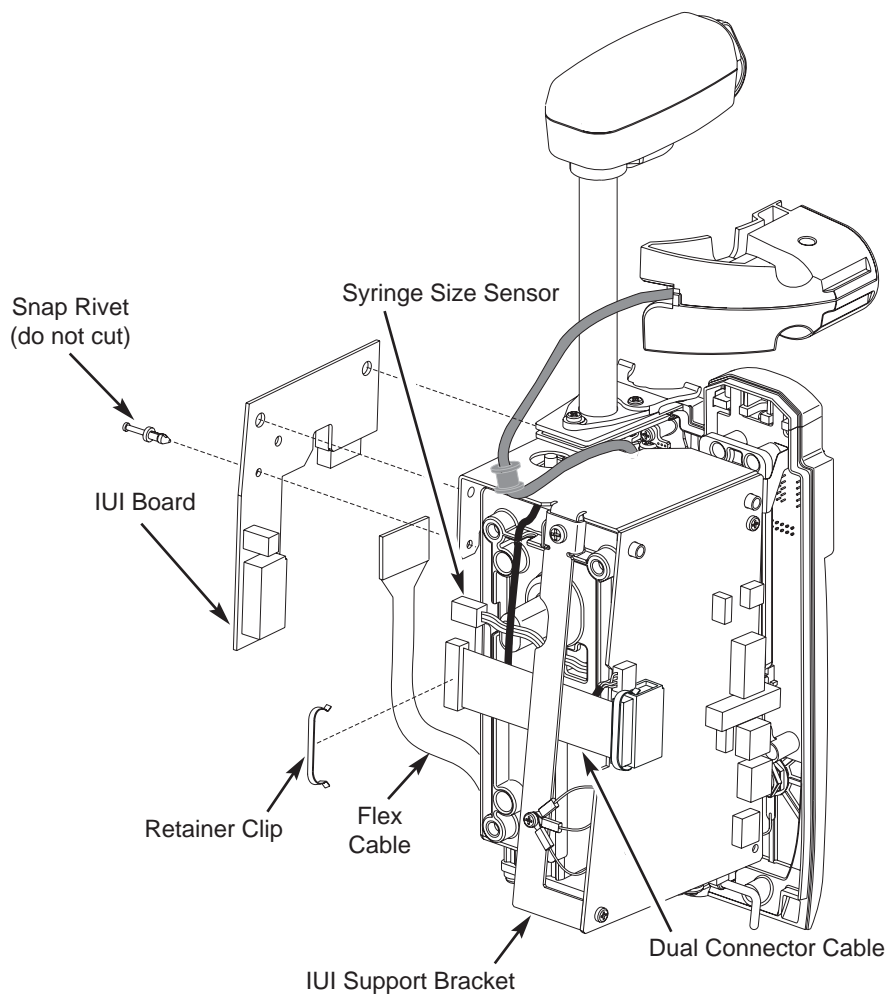
#### CAUTION

Do not cut rivet.

6. Remove IUI Board.

#### During Reassembly:

Route Dual Connector Cable and Syringe Size Sensor harness under IUI Support Bracket.



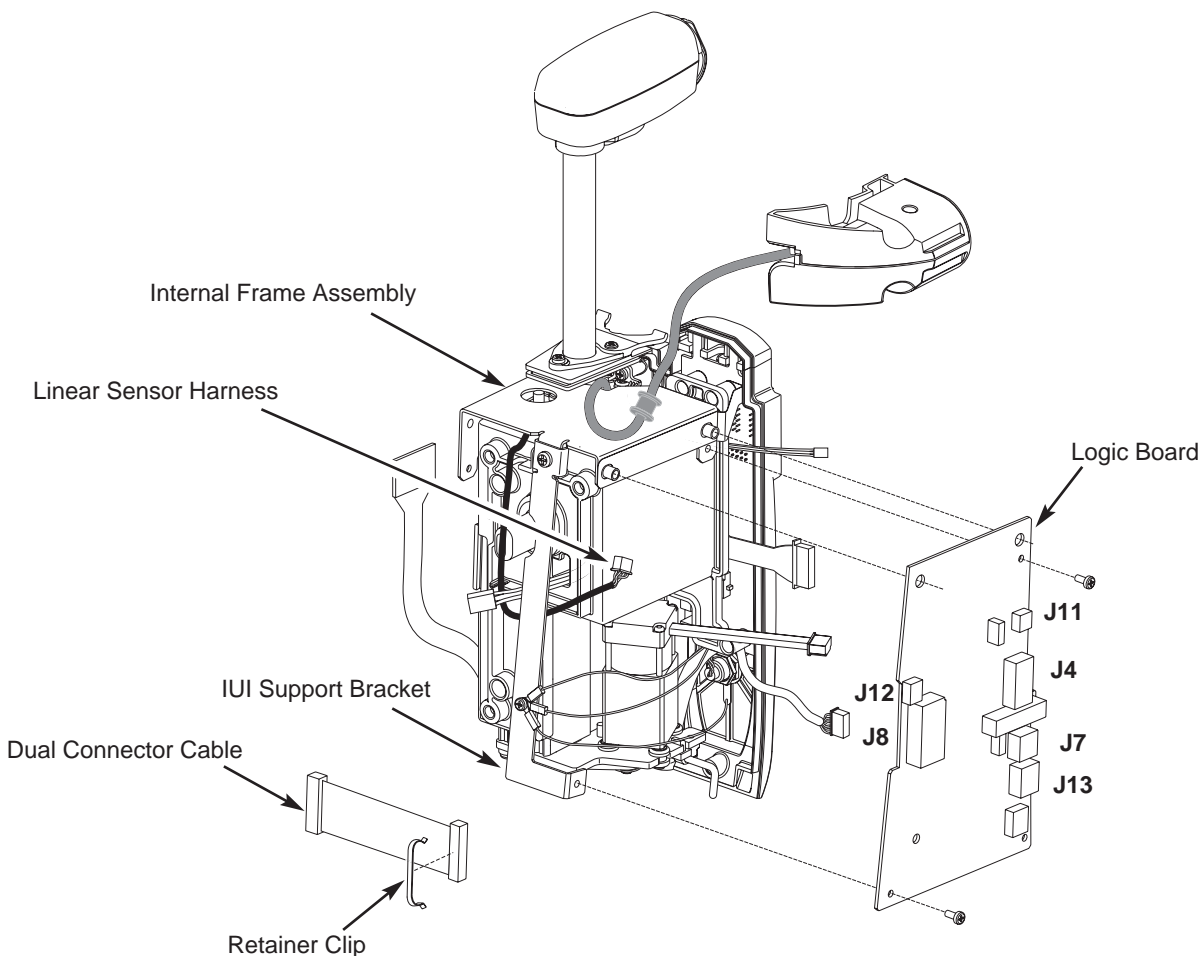
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.8 Removing Logic Board Assembly

1. If present, remove Retainer Clip from Dual Connector Cable-Logic Board connection.
2. Disconnect Dual Connector Cable from Logic Board J8.
3. Disconnect Linear Sensor Harness from Logic Board J12.
4. Remove one (1) screw attaching Logic Board to IUI Support Bracket.
5. Remove one (1) screw attaching Logic Board to Internal Frame Assembly.
6. Disconnect harnesses from following locations on Logic Board:  
J4 (display)  
J7 (motor)  
J11 (flange detect)  
J13 (lock harness)
7. Remove Logic Board.

#### During Reassembly:

Route Dual Connector Cable and Linear Sensor Harness under IUI Support Bracket.



## CORRECTIVE MAINTENANCE

PCA Module

### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

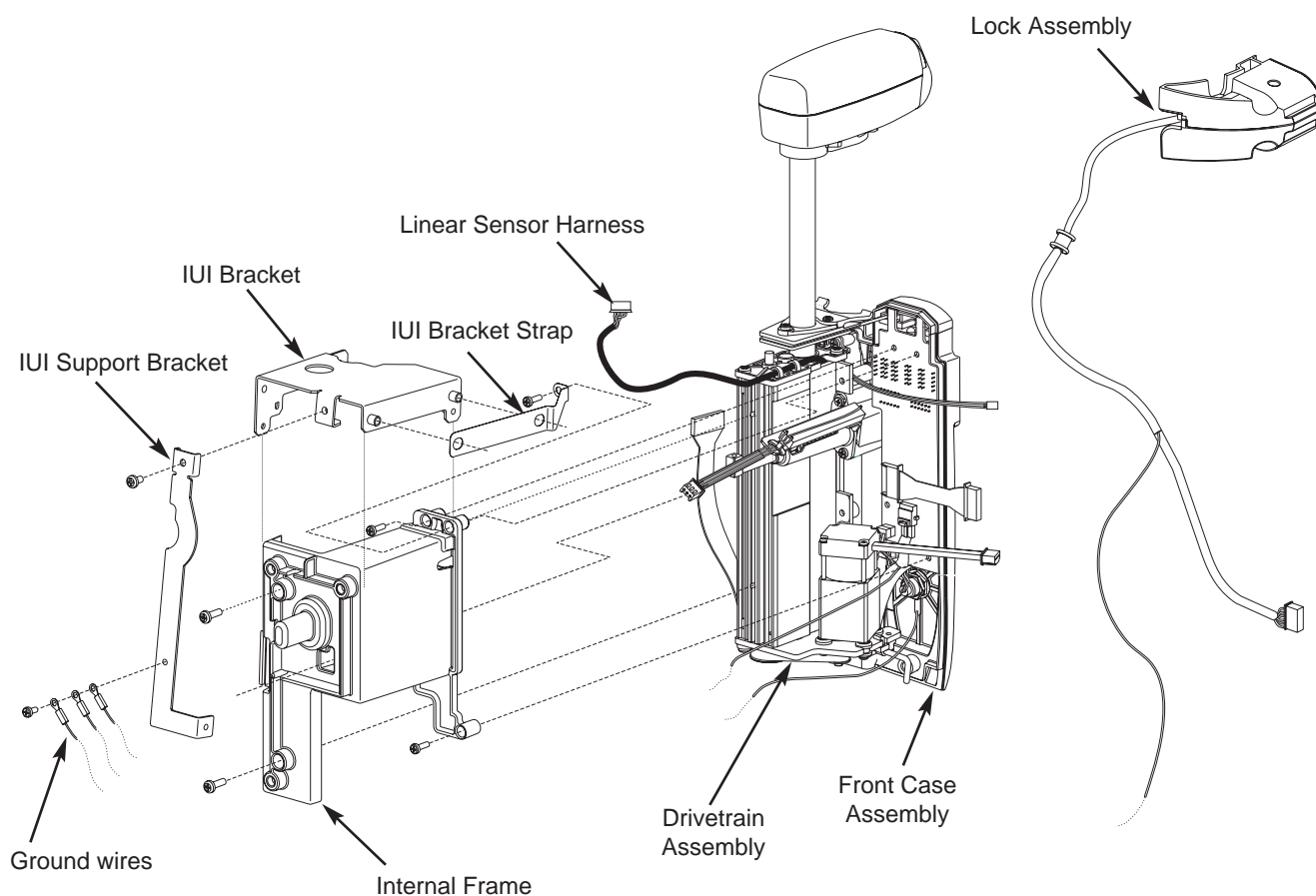
#### 5.2.9 Removing Internal Frame Assembly

1. Remove one (1) screw attaching three (3) ground wires to IUI Support Bracket.
2. Remove three (3) screws attaching Internal Frame to Front Case Assembly.
3. Remove IUI Bracket Strap.
4. Remove one (1) screw attaching IUI Support Bracket to IUI Bracket.
5. Remove IUI Support Bracket and IUI Bracket.

6. Remove two (2) screws attaching Internal Frame to Drivetrain Assembly.
7. Remove Internal Frame.

#### During Reassembly:

- Route Linear Sensor Harness between IUI Bracket and Internal Frame.
- Route Lock Assembly harness through top of and under Internal Frame so that Frame does not pinch harness when attached to Front Case, and harness can reach Logic Board J13.



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

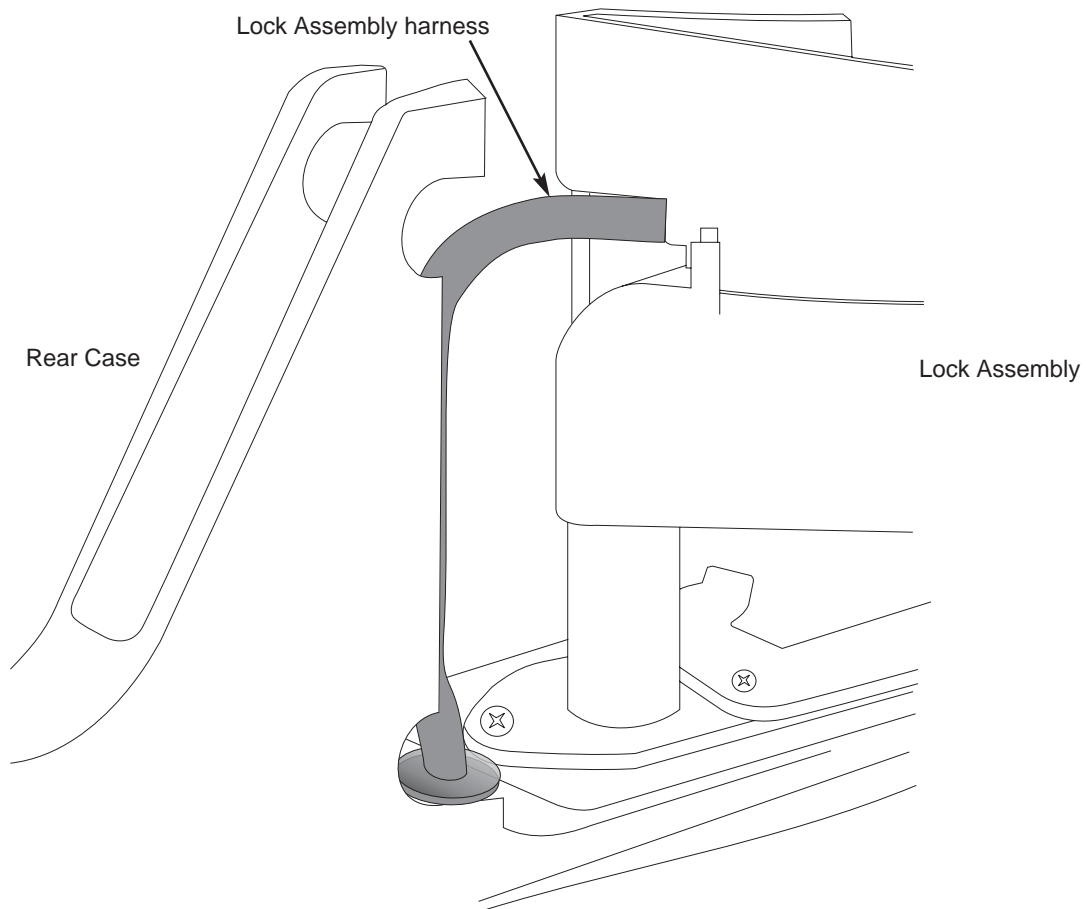
### 5.2.10 Removing Lock Assembly

1. Already disassembled: Handle, Rear Case, IUI and Logic Boards, and Internal Frame.
2. Remove Lock Assembly.

**NOTE:** Remove or install the Lock Assembly harness carefully to avoid damage to the harness.

#### During Reassembly:

Route Lock Assembly harness through top of and under Internal Frame so that Frame does not pinch harness when attached to Front Case, and harness can reach Logic Board J13.



## CORRECTIVE MAINTENANCE

PCA Module

### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

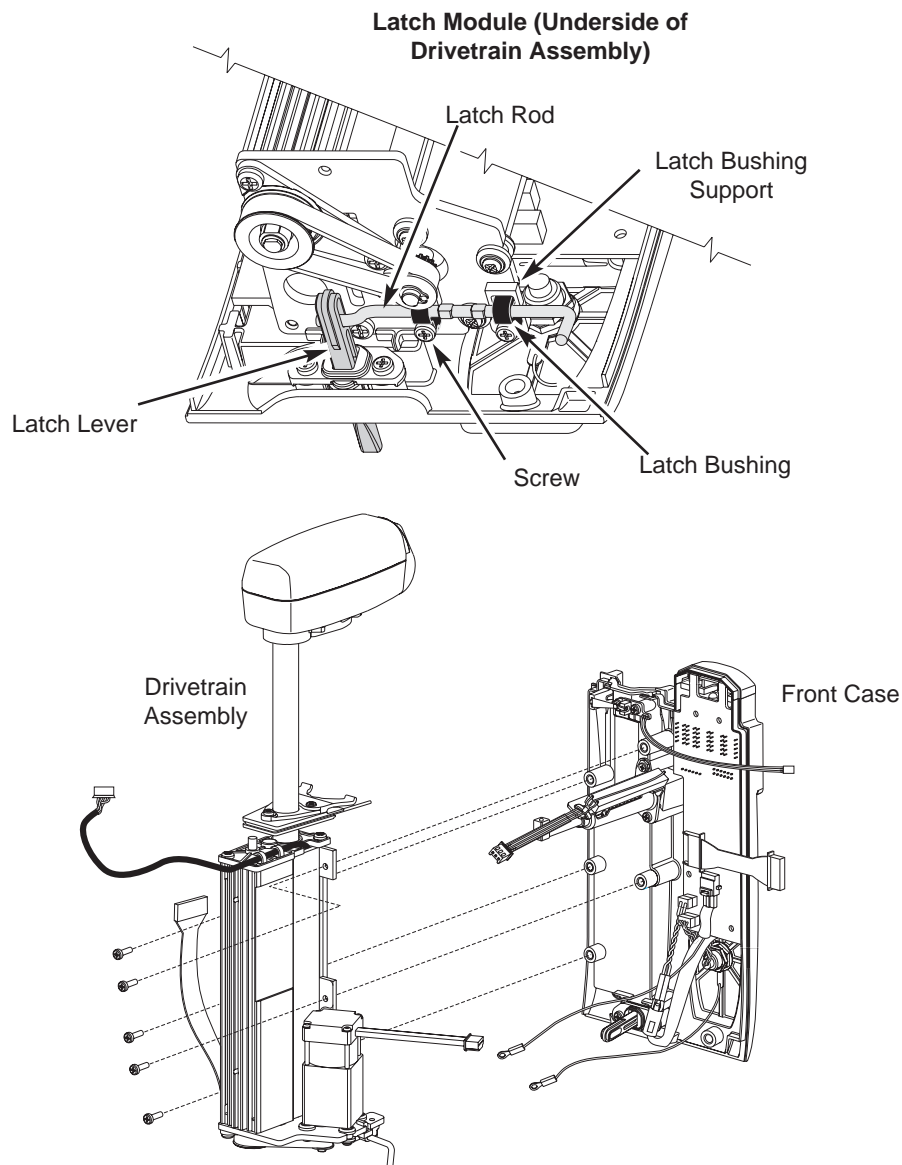
#### 5.2.11 Removing Latch Module and Drivetrain Assembly

1. Remove two (2) screws on Latch Bushings and remove Latch Module from underside of Drivetrain.
2. Disassemble Latch Module parts (Latch Bushing Supports, Latch Bushings, Latch Rod).

3. Remove five (5) screws attaching Drivetrain Assembly to Front Case, and remove Drivetrain Assembly.

#### During Reassembly:

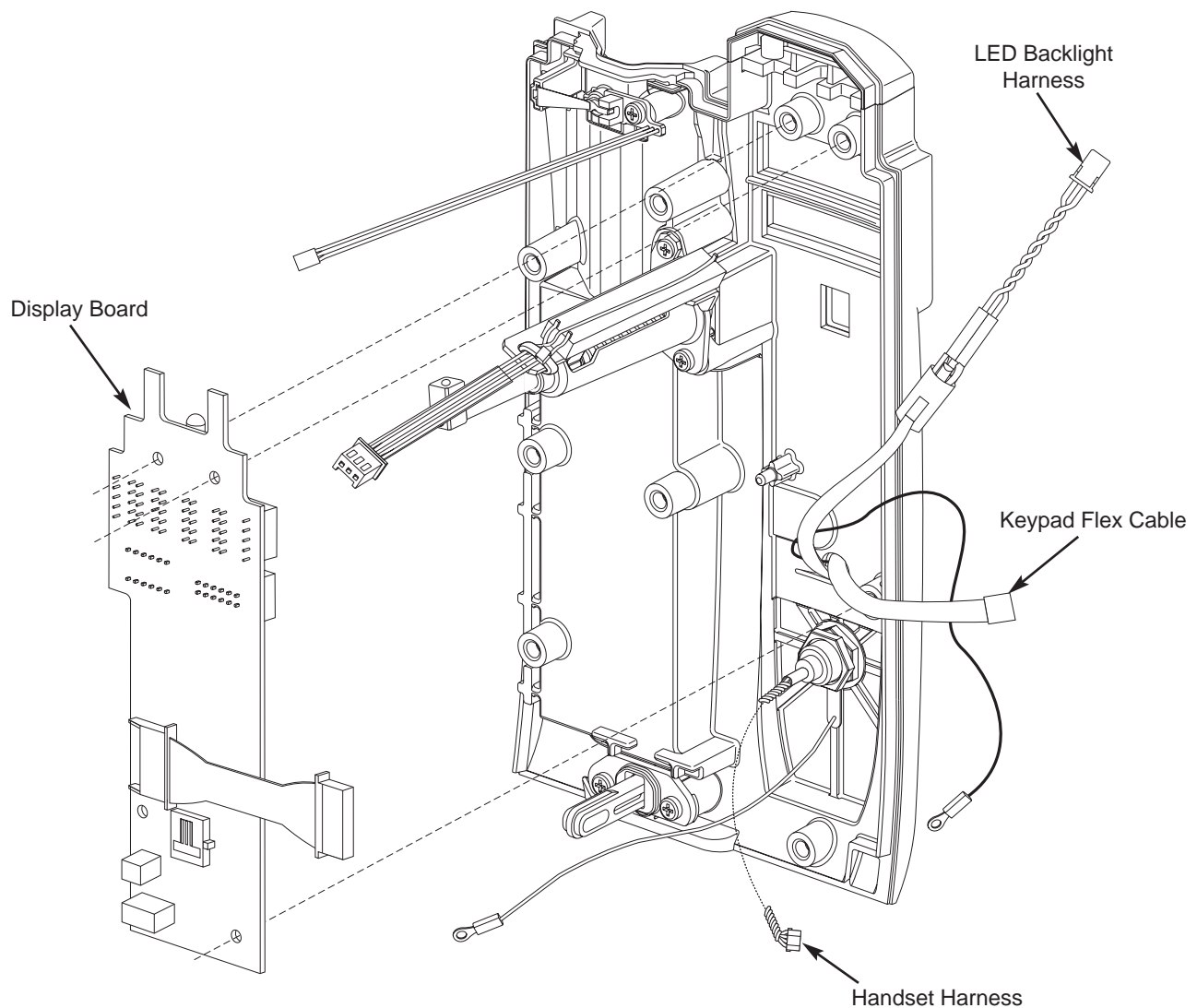
- Ensure both legs of Latch Bushings seat in the square cutouts on Drivetrain bottom plate.
- Thread Latch Rod through Latch Lever.



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.12 Removing Display Board Assembly

1. Disconnect cables from these Display Board connectors:
  - J1 (keypad)
  - J3 (Handset Harness)
  - J4 (backlight)
2. Remove Display Board.



## CORRECTIVE MAINTENANCE

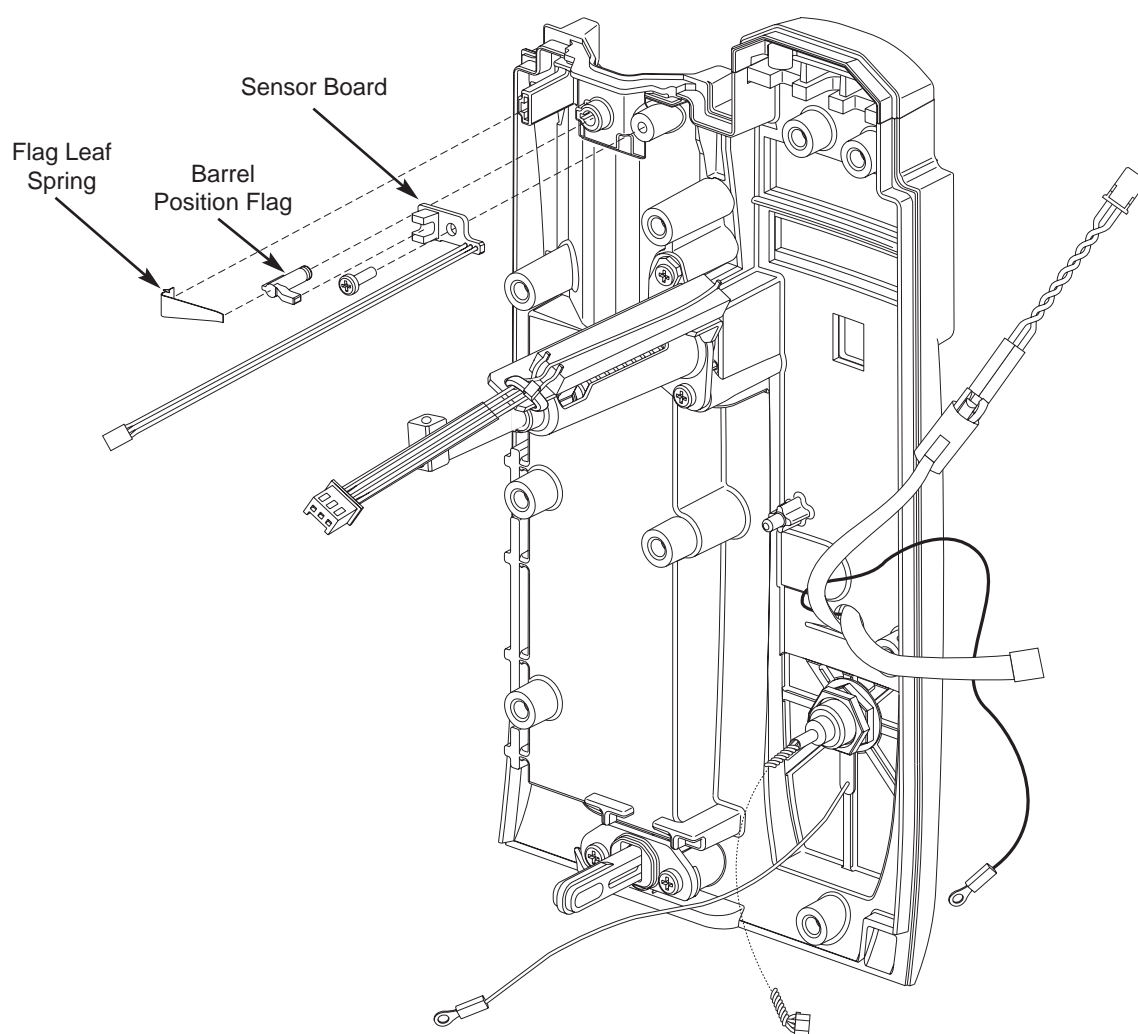
PCA Module

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### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

#### 5.2.13 Removing Sensor Board Assembly

1. Remove Flag Leaf Spring and Barrel Position Flag as required.
2. Remove one (1) screw attaching Sensor Board to Front Case.
3. Remove Sensor Board.





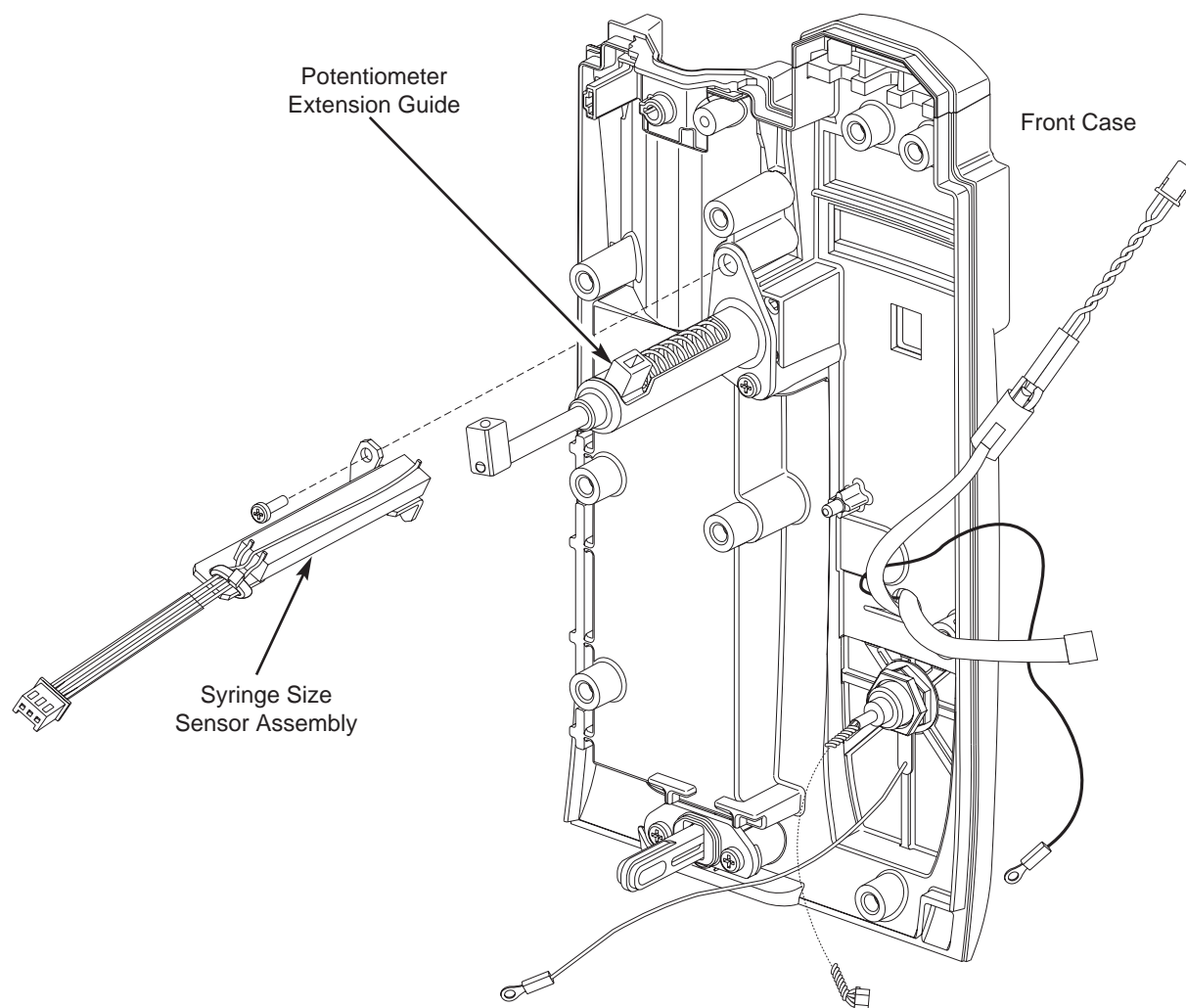
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.14 Removing Syringe Size Sensor Assembly

1. Remove one (1) screw attaching Syringe Size Sensor Assembly and Shaft Support to Front Case.
2. Remove Syringe Size Sensor Assembly.

#### During Reassembly:

1. Insert tab on Syringe Size Sensor Assembly into Potentiometer Extension Guide.
2. Secure Syringe Size Sensor Assembly to Front Case.



## CORRECTIVE MAINTENANCE

PCA Module

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### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

#### 5.2.15 Removing Syringe Barrel Clamp Assembly

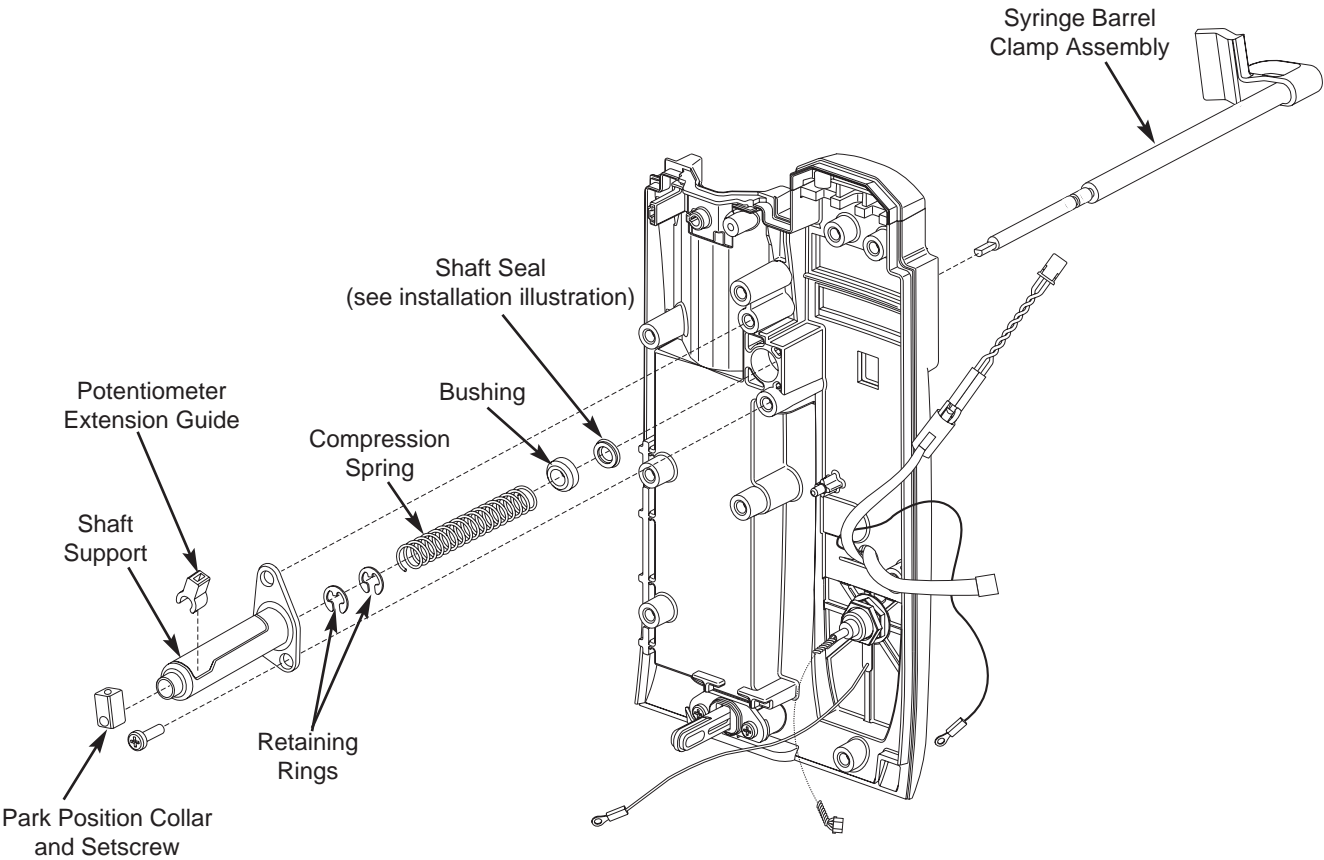
1. Loosen set screw securing park position collar to Barrel Clamp and remove collar.
2. Remove Potentiometer Extension Guide.
3. Remove one (1) screw attaching Shaft Support to Front Case.
4. Remove Retaining Rings, Compression Spring, Bushing and Barrel Clamp.

#### During Reassembly:

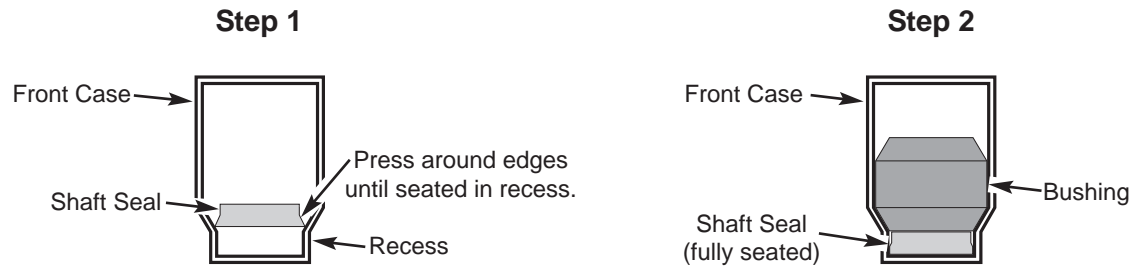
1. If Shaft Seal has been removed:
  - a. Reinstall with wide lip facing Front Case.
  - b. Use a #2 flat-bladed screwdriver to carefully push around edges of seal until it is fully seated into Front Case recess.
  - c. Verify seal is completely seated by slowly pulling Barrel Clamp out  $\frac{1}{2}$  to 1 inch and then slowly pushing it back in, ensuring seal does not move out of recess.
2. Potentiometer Extension Guide:
  - a. Fully retract Barrel Clamp (seat against Front Case).
  - b. Insert Potentiometer Extension Guide through Shaft Support and “snap” into place on shaft.
3. Tighten park position collar setscrew against flat on end of shaft.

5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.15 Removing Syringe Barrel Clamp  
Assembly (Continued)



Shaft Seal Installation



## CORRECTIVE MAINTENANCE

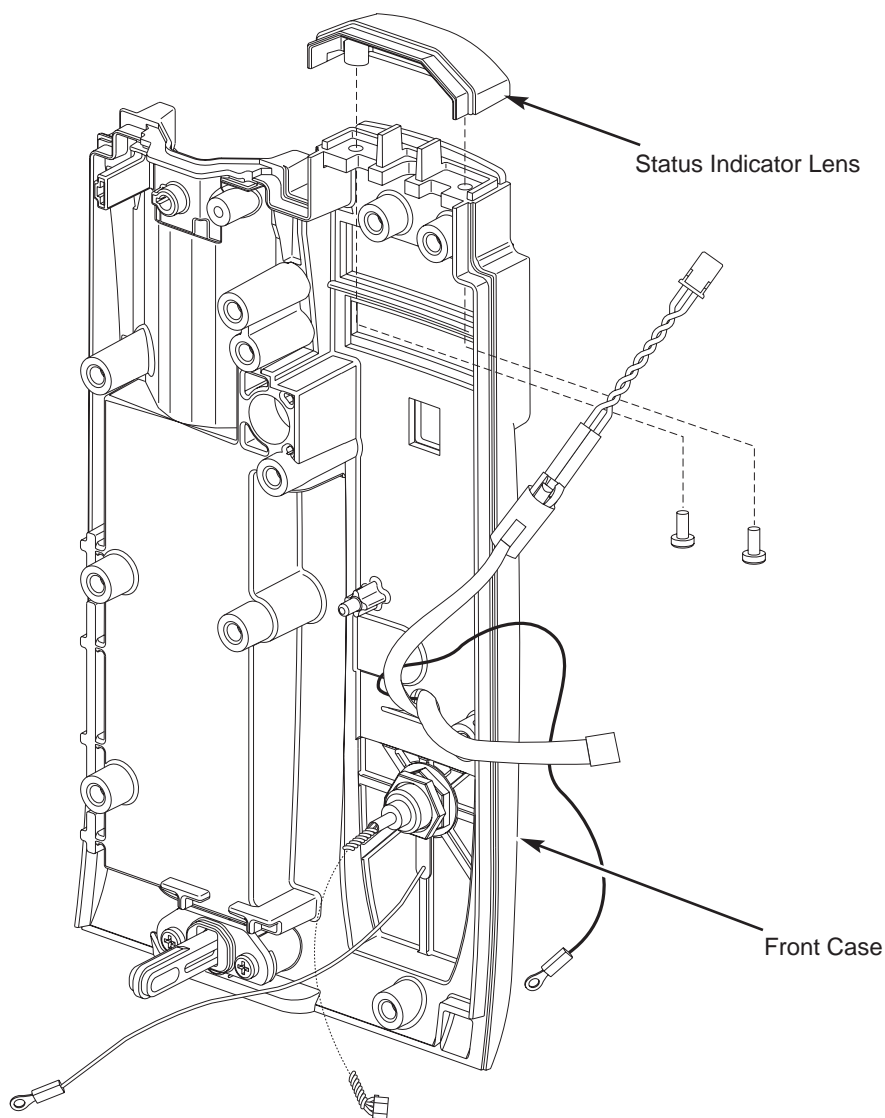
PCA Module

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### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

#### 5.2.16 Removing Status Indicator Lens

1. Remove two (2) screws attaching Status Indicator Lens to Front Case.
2. Remove Status Indicator Lens.



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

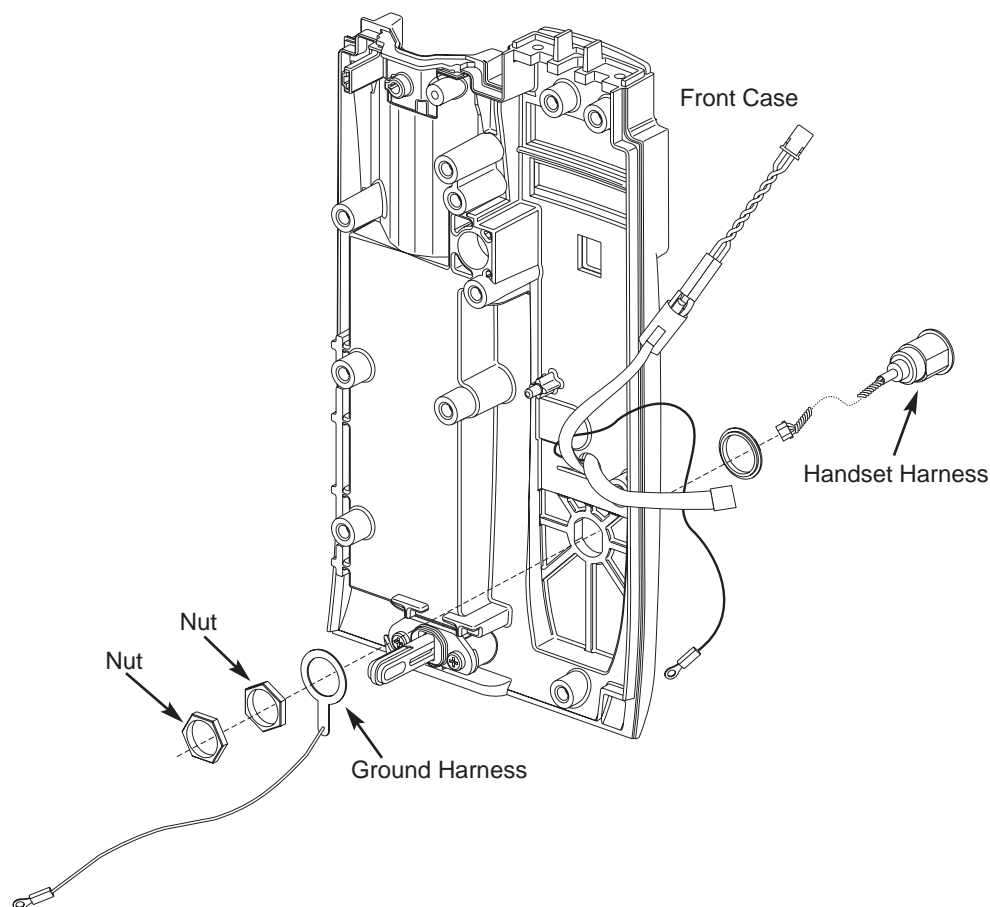
### 5.2.17 Removing Handset Harness

**NOTE:** Use a  $\frac{9}{16}$ -in. deep-well socket at least 4 in. deep to remove and install the Handset Harness.

1. Ensure that  $\frac{9}{16}$ -in. socket is on top nut, then remove top nut (first of 2 nuts) that secures Handset Harness to Front Case.
2. Use socket to remove second nut.
3. Remove Ground Harness.
4. Remove Handset Harness (already disconnected from Display Board J3).

#### During Reassembly:

1. Install Handset Harness with red dot pointing to top of Front Case.
2. Install Ground Harness, then install first nut and tighten.
3. Install second nut and tighten, ensuring that socket is on top nut (second of 2 nuts) only.
4. Connect Handset Harness to Display Board J3.



## CORRECTIVE MAINTENANCE

PCA Module

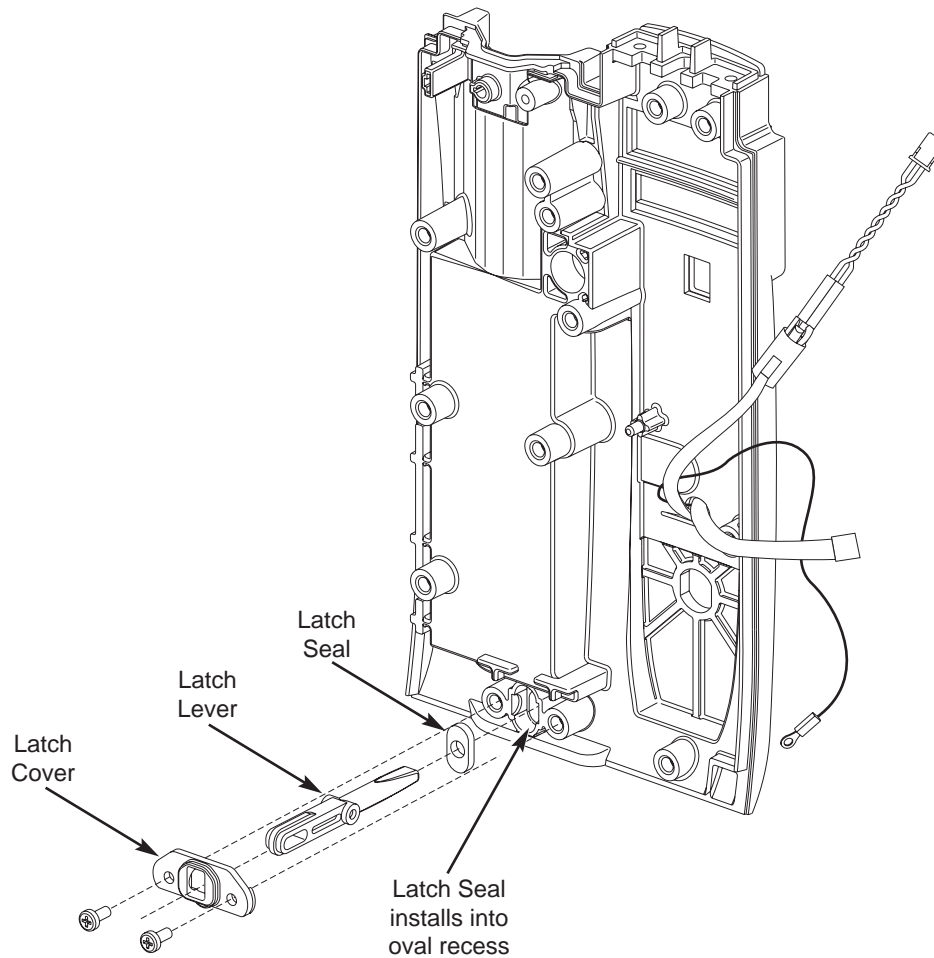
### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

#### 5.2.18 Removing Latch Lever Assembly

1. Remove two (2) screws attaching Latch Cover to inside of Front Case.
2. Remove Ground Harness.
3. Remove Latch Lever and Latch Seal.

#### During Reassembly:

1. Install Latch Seal onto shaft of Latch Lever.
2. Install Latch Lever into Front Case, using a blunt instrument to seat seal into oval recess.
3. Attach Latch Cover to Front Case.



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.19 Removing Housing Assembly and Guide Rod

#### CAUTION

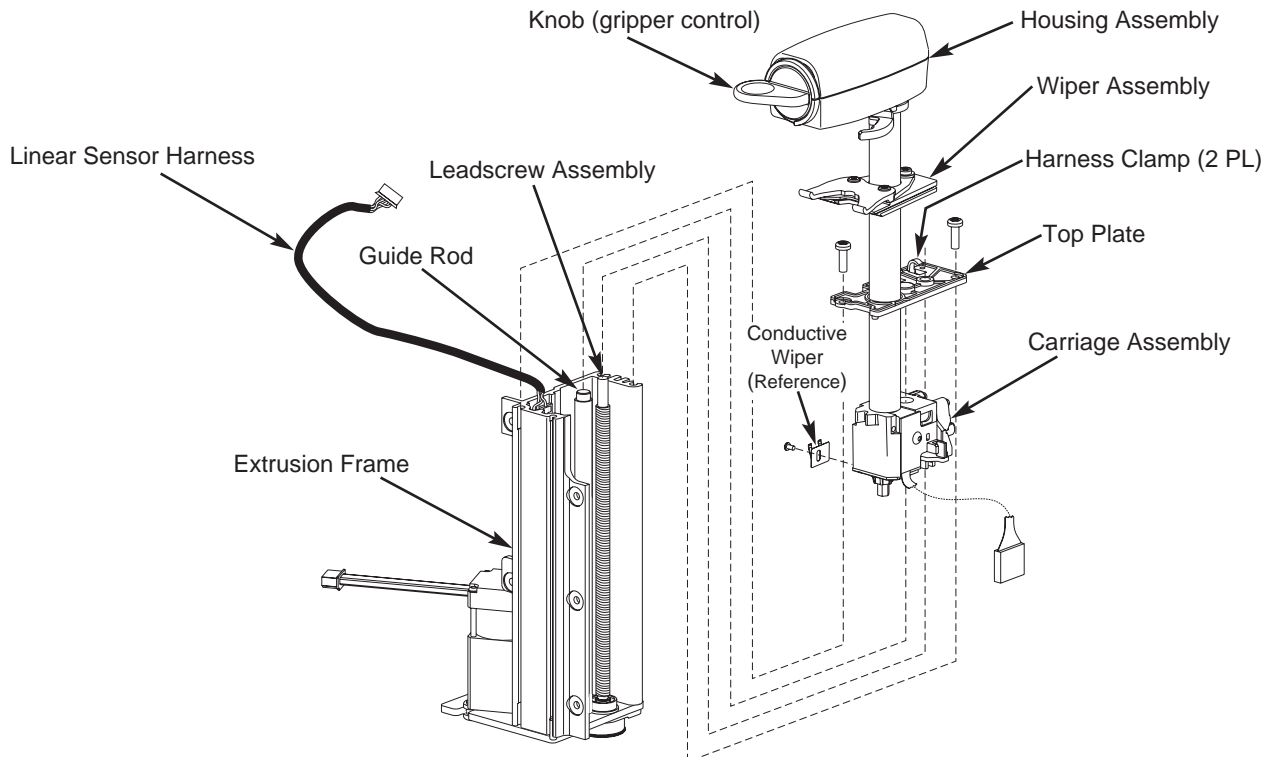
Use EXTREME CAUTION when removing Housing Assembly. If the Conductive Wiper is damaged, replace the entire Lower Housing/Carriage Assembly.

1. Pull Linear Sensor Harness loose from clamps on Top Plate.
2. Remove two (2) screws attaching Top Plate to Extrusion Frame.
3. Gently place assembly in a standing position and orient it with motor facing inward.

#### CAUTION

When performing the next step, use care to avoid damaging the leadscrew pulley.

4. Rotate knob (gripper control) to disengage plunger grippers and slowly raise Housing Assembly until Carriage Assembly nears top of Extrusion Frame.
5. Angle Housing Assembly away from Linear Sensor Assembly so that Conductive Wiper does not contact Linear Sensor.
6. Gently remove Housing Assembly.
7. Lift Guide Rod from Bottom Plate and remove.



## CORRECTIVE MAINTENANCE

PCA Module

### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

#### 5.2.20 Removing Motor/Pulley Assembly

1. Remove four (4) screws attaching Motor/Pulley Assembly to Bottom Plate.
2. Remove Motor Belt.
3. Remove Motor/Pulley Assembly.

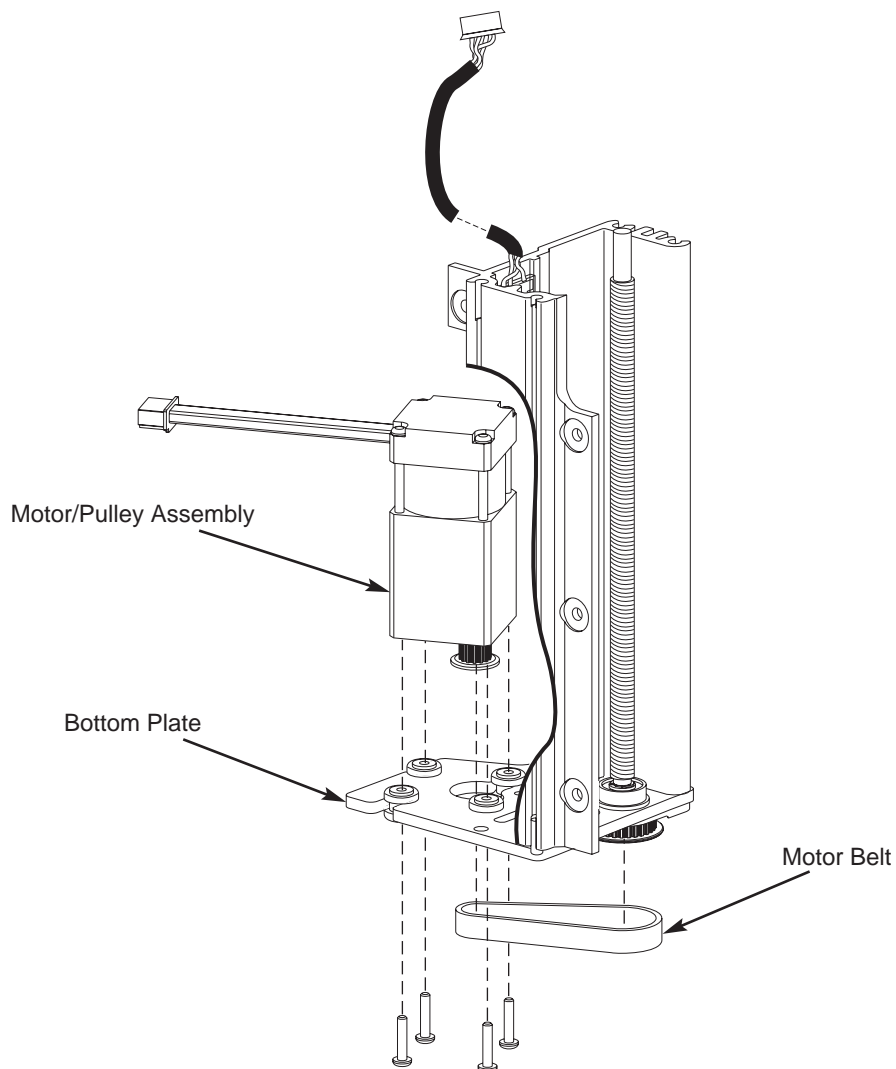
#### During Reassembly:

1. To prevent pinion damage, install Motor/Pulley Assembly through Bottom Plate at a slight angle.

#### 2. Install Motor Belt:

- a. Install wide end of belt onto leadscrew pulley.
- b. Tilt Motor/Pulley Assembly and install other end of belt onto motor pulley. Do not stretch belt to fit over pulley.

#### 3. Screw Motor/Pulley Assembly into place.





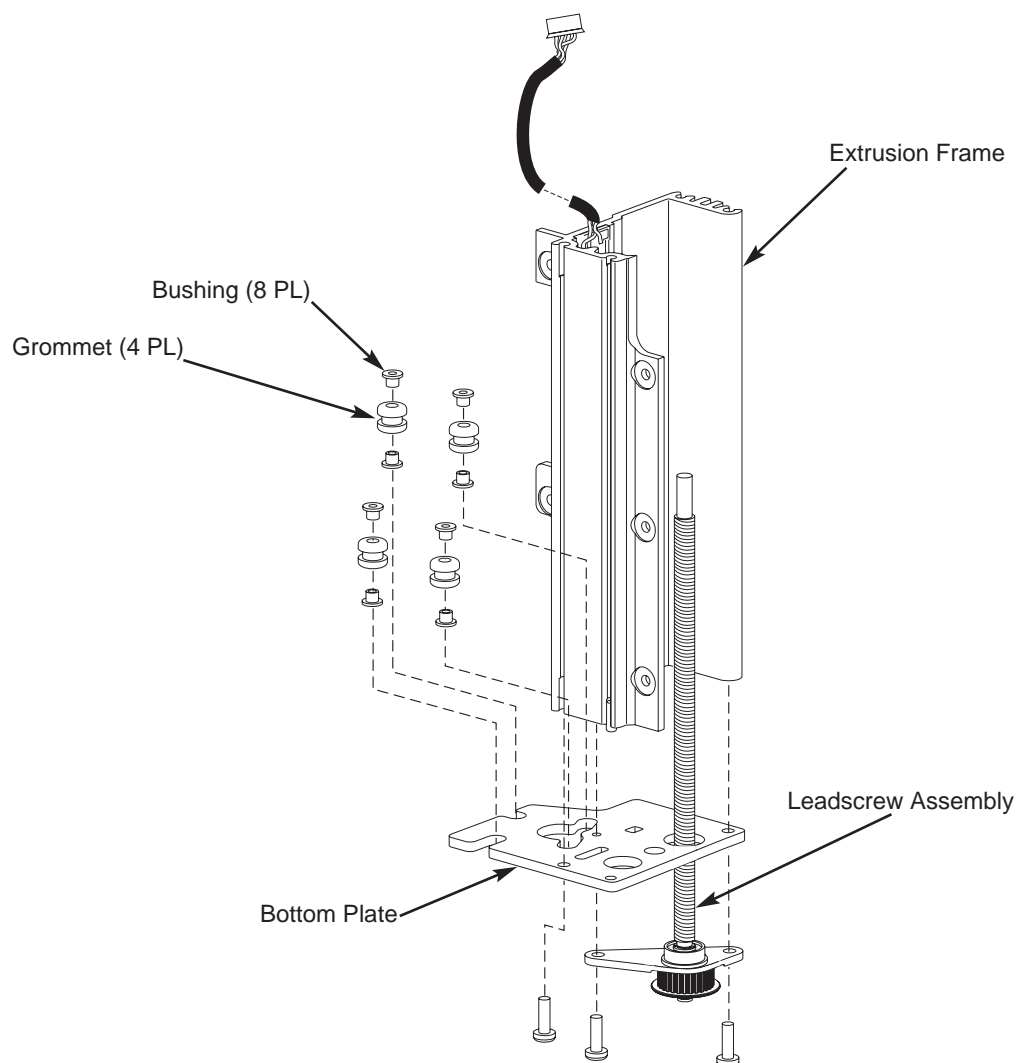
## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.21 Removing Leadscrew Assembly and Bottom Plate

1. Remove two (2) screws attaching Leadscrew Assembly to Bottom Plate.
2. Remove Leadscrew Assembly.
3. Remove remaining screw attaching Bottom Plate to Extrusion Frame.
4. Remove Bottom Plate.

#### During Reassembly:

If replacing Bottom Plate, remove bushings and grommets from old plate and install into new plate.



## CORRECTIVE MAINTENANCE

PCA Module

### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

#### 5.2.22 Removing Linear Sensor Assembly

##### CAUTION

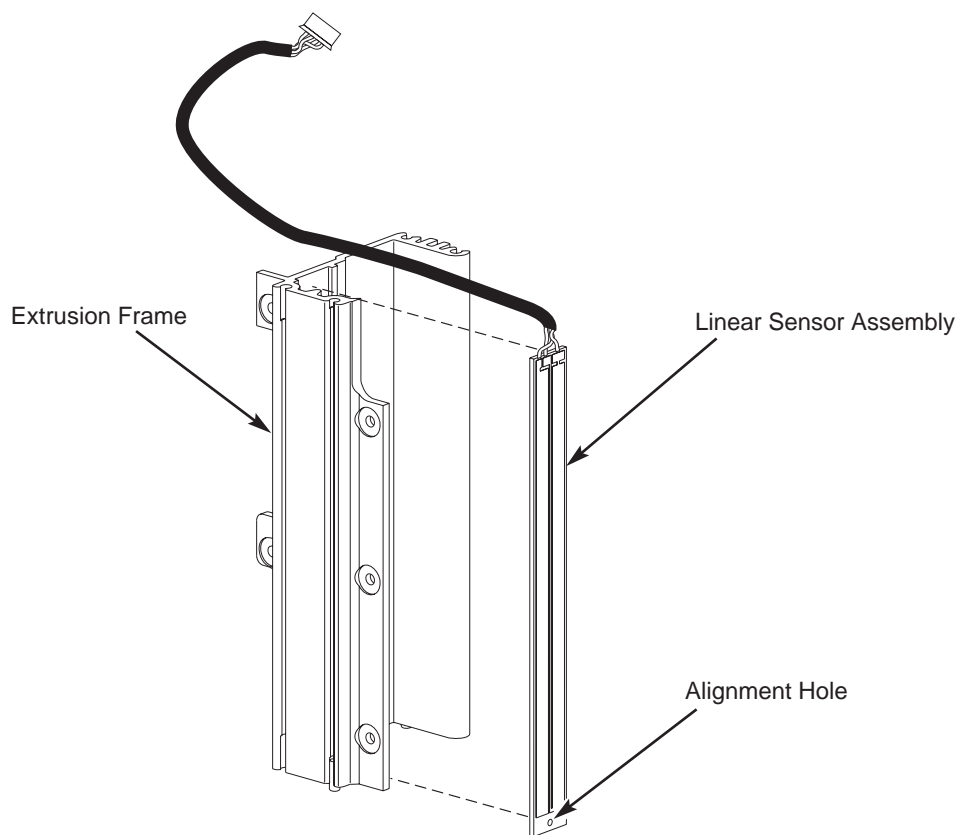
To avoid damaging the Linear Sensor Assembly, do not touch with bare hands.

1. Peel Linear Sensor Assembly off Extrusion Frame.
2. Use alcohol to clean adhesive debris from Extrusion Frame.

##### During Reassembly:

1. Ensure Extrusion Frame surface is clean.

2. Before adhering Linear Sensor Assembly to Extrusion Frame:
  - a. Remove protective backing from Linear Sensor.
  - b. Align hole in Linear Sensor Assembly with hole in Extrusion Frame.
3. Use a burnishing tool to ensure that Linear Sensor Assembly is securely adhered to Extrusion Frame.
4. Clean Linear Sensor Assembly surface using alcohol and lint-free cloth (such as Kimwipes or lint-free tissue).



## 5.2 DISASSEMBLY/REASSEMBLY (Continued)

### 5.2.23 Removing Force Sensor and Actuator Knob Assemblies

1. Loosen four (4) screws attaching Upper Housing to Lower Housing just far enough to remove Upper Housing, leaving O-Rings attached to screws.

**NOTE:** To avoid losing O-Rings, push each screw upward to grab and hold its O-Ring before removing screws from Upper Housing.

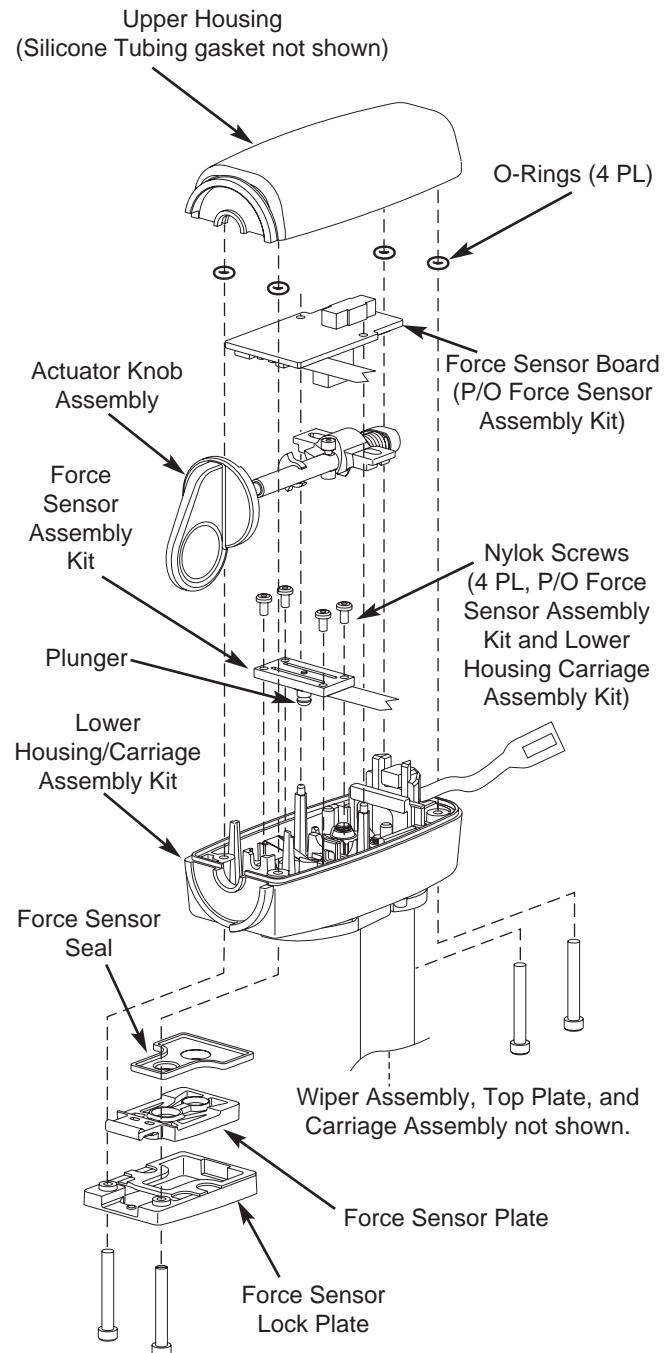
2. Disconnect flex cable from Force Sensor Board J1.
3. Lift Force Sensor Board off mounting posts.
4. Remove Actuator Knob Assembly.
5. Remove four (4) screws attaching Force Sensor Assembly to Lower Housing.
6. Remove Force Sensor Assembly.
7. Remove Force Sensor Lock Plate, Force Sensor Plate, Force Sensor Seal and Upper Housing.

**During Reassembly:** (see Figure 7B-1)

- Ensure Silicone Tubing gasket in Upper Housing is undamaged and in place.
- Ensure Plunger Flag (part of Lower Housing Assembly) and Force Sensor Assembly plunger are seated in Force Sensor Seal.
- Ensure Force Sensor Assembly flex cable is tucked inside upper and lower housings.

#### CAUTION

To avoid damaging Lower Housing, use Nylok screws to install Force Sensor Assembly.



## CORRECTIVE MAINTENANCE

PCA Module

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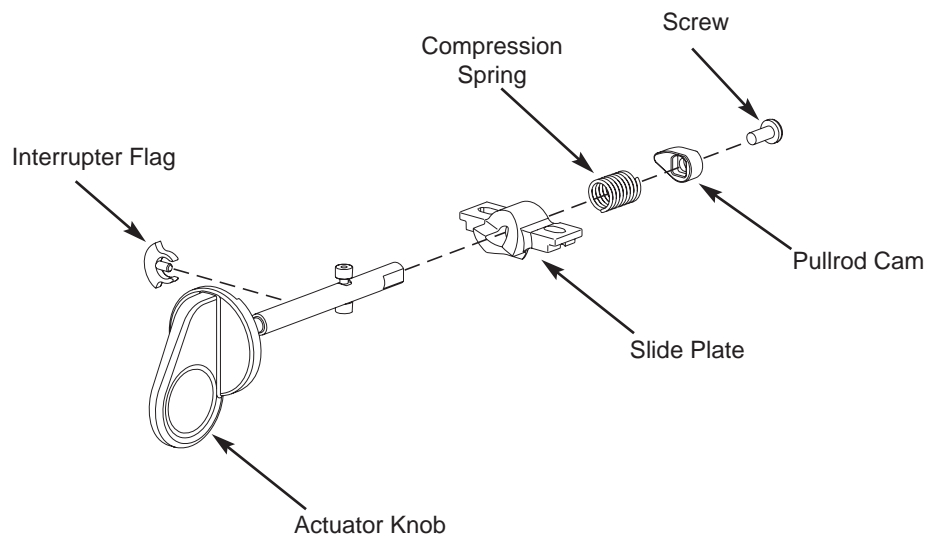
### 5.2 DISASSEMBLY/REASSEMBLY (Continued)

#### 5.2.24 Removing Actuator Knob Assembly Parts

1. Use a small pair of needle-nose pliers to gently pull Interrupter Flag from Actuator Knob Assembly.
2. Remove screw to remove Slide Plate, Compression Spring, and Pullrod Cam.

#### During Reassembly:

- Install Slide Plate and Compression Spring onto Actuator Knob, compress Spring with Pullrod Cam, then install screw.



**Table 5B-2. Torque Values - PCA Module**

Functional Application	Item Description	Torque Value
<b>DRIVETRAIN ASSEMBLY</b>		
Bottom Plate	6-32 x $\frac{7}{16}$	12 in-lb
Leadscrew Assembly	6-32 x $\frac{7}{16}$	12 in-lb
Motor/Pulley Assembly	M2.5 x 12	4 in-lb
Top Plate	6-32 x $\frac{7}{16}$	6 in-lb
<b>FINAL ASSEMBLY</b>		
Handle Assembly	4-40 x $\frac{3}{4}$	6 in-lb
IUI Connectors	6-32 x $\frac{7}{16}$	12 in-lb
Latch Assembly	4-40 x $\frac{3}{8}$ Torx Security	6 in-lb
Lock Assembly - Left Handle	4-40 x $\frac{5}{16}$	6 in-lb
Rear Case - Front Case	4-40 x $\frac{5}{16}$	6 in-lb
Rear Case - Internal Frame	6-32 x $\frac{7}{16}$	12 in-lb
Rear Door - Front Case	4-40 x $\frac{1}{4}$ Torx Security	6 in-lb
Right and Left Door - Hinge	4-40 x $\frac{1}{4}$ Torx Security	6 in-lb
<b>FRONT CASE ASSEMBLY</b>		
Drivetrain Assembly - Front Case	4-40 x $\frac{5}{16}$	6 in-lb
Handset Harness - Front Case	Lemo Jam Nuts	40 in-lb
Internal Frame - Drivetrain Assembly	6-32 x $\frac{5}{16}$	12 in-lb
Internal Frame - Front Case	4-40 x $\frac{5}{16}$	6 in-lb
IUI Support Bracket	6-32 x $\frac{5}{16}$	12 in-lb
Latch Cover - Front Case	4-40 x $\frac{5}{16}$	6 in-lb
Logic Board	4-40 x $\frac{5}{16}$	6 in-lb
Park Position Collar	setscrew - <u>no</u> nylon patch	6 in-lb
	setscrew - <u>with</u> nylon patch	10 in-lb
Sensor Board	4-20 x $\frac{5}{16}$	6 in-lb
Status Indicator Lens	4-20 x $\frac{5}{16}$	6 in-lb
Syringe Barrel Clamp Assembly	4-40 x $\frac{5}{16}$	6 in-lb
Syringe Size Sensor Assembly	4-40 x $\frac{5}{16}$	6 in-lb
<b>HOUSING / CARRIAGE ASSEMBLY</b>		
Actuator Knob Assembly	4-40 x $\frac{1}{4}$	6 in-lb
Force Sensor Assembly	2-56 x $\frac{3}{16}$	6 in-lb
Upper - Lower Housing	4-20 x 1	8 in-lb

## CORRECTIVE MAINTENANCE

### PCA Module

**Table 5B-3. Level of Testing Guidelines - PCA Module**

Tests to Perform →	Alarm Test	Barrel Size Accuracy Verification	Barrel Size Calibration	Binary Switches Test	Channel ID/UI Connector Test	Keypad Test	Plunger Force Accuracy Verification	Plunger Force Sensor Calibration	Plunger Position Accuracy Verification	Plunger Position Calibration	Simultaneous Display Test	Visual/Instrument Inspection
● = Required X = If verification fails. Blank = Not Applicable  Repair/Replacement of: ↓												
Actuator Knob Assy.				●			●	X	●	X		●
Display Board	●				●	●					●	●
Drivetrain Assy.				●	●		●	X	●	●		●
Force Sensor Assy.				●			●	●	●	X		●
Front Case		●	X		●	●					●	●
Front and Rear Door				●								
Handle Assy.												●
Handset Harness				●	●							
Housing/Carriage Assy., Lower				●	●		●	●	●	●		●
Housing Assy., Complete				●	●		●	X	●	X		●
Internal Frame Assy.					●							●
IUI Board		●	X		●		●	X	●	X		●
IUI Connector Assy.					●							●
Latch Assy.												●
Latch Lever					●							●
Leadscrew Assy.					●		●	●	●	●		●
Lock Assy.					●	●						
Logic Board		●	●		●		●	●	●	●		●
Rear Case					●							●
Sensor Board				●	●		●	X	●	X		●
Status Indicator Lens	●				●						●	●

-- Continued Next Page --

**Table 5B-3. Level of Testing Guidelines - PCA Module (Continued)**

Tests to Perform →	Alarm Test	Barrel Size Accuracy Verification	Barrel Size Calibration	Binary Switches Test	Channel ID/UI Connector Test	Keypad Test	Plunger Force Accuracy Verification	Plunger Force Sensor Calibration	Plunger Position Accuracy Verification	Plunger Position Calibration	Simultaneous Display Test	Visual/Instrument Inspection
● = Required X = If verification fails. Blank = Not Applicable												
Repair/Replacement of: ↓												
Syringe Barrel Clamp assy.		●	●	●								
Syringe Size Sensor Assy.		●	●	●	●							●
Miscellaneous: ↓												
Instrument dropped	●	●		●	●	●	●		●		●	●
Instrument software flashed												●
New instrument checkout	●	●		●	●	●	●		●		●	●
No fault found (instrument not opened)	●			●	●	●					●	●
No fault found (instrument opened)	●	●		●	●	●	●		●		●	●

**NOTES:**

- Use the Maintenance Software to perform testing and calibration.
- After performing any calibration procedure, always perform the associated verification test.

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## Chapter 6 — TROUBLESHOOTING

**NOTE:** Replacing the Complete Housing Assembly, Force Sensor Assembly, or Logic Board Assembly in a module with version 7.0 or earlier software requires special calibration equipment. Until version 7.1 or later is installed in the module, these assemblies must be replaced at the depot. Call Cardinal Health Technical Support (800.854.7128 ext. 6003) for assistance and information.

### 6.1 INTRODUCTION

This chapter describes possible problems that can occur while using a Syringe or PCA Module. Refer to this chapter before attempting to service the module.

To facilitate troubleshooting when an operating malfunction occurs, the Syringe and PCA Modules alarm and display an error message and/or error code. The information in this chapter can help diagnose and correct technical problems. Use Maintenance Software to perform applicable preventive maintenance, calibration, and verification procedures.

## TROUBLESHOOTING

**Table 6-1. Technical Troubleshooting Guide**

Follow the steps in order until the problem/fault is corrected. Before making a final diagnosis, visually inspect the instrument for damage. Following repair/replacement, use Maintenance Software to perform the required tests. See Table 5A-3 (Syringe Module) or Table 5B-3 (PCA Module).

Message	Probable Cause	Remedy
Channel Disconnected	<ol style="list-style-type: none"><li>Channel disconnected during operation.</li><li>Channel communication problem with Inter Unit Interface (IUI).</li></ol>	<ol style="list-style-type: none"><li>Reconnect module to PC Unit. Syringe Module only: reprogram infusion setup.</li><li>Visually inspect IUIs on module and PC Unit. If necessary, replace IUI Connector.</li><li>Return to factory.</li></ol>
Channel Errors	<ol style="list-style-type: none"><li>Module error detected.</li></ol>	<ol style="list-style-type: none"><li>Refer to Tables 6-2, 6-3 and 6-4 to diagnose and correct problem.</li><li>Perform applicable preventive maintenance, calibration, and verification.</li><li>Return to factory.</li></ol>
Check Syringe	<ol style="list-style-type: none"><li>Syringe and/or drivearm obstruction.</li><li>Plunger head not engaged.</li><li>Barrel Clamp not closed.</li><li>Flange detect sensor not engaged.</li><li>Binary switches not working properly or sensors defective.</li><li>Force sensor harness disconnected and/or defective.</li><li>Syringe Size Sensor Assembly harness disconnected and/or defective.</li><li>Linear Sensor harness disconnected and/or defective.</li></ol>	<ol style="list-style-type: none"><li>Check drivearm and syringe travel.</li><li>Lower plunger head onto syringe.</li><li>Close Barrel Clamp over syringe.</li><li>Ensure flange detect sensor is engaged.</li><li>Perform Binary Switches Test using Maintenance Software.</li></ol> <div><b>NOTE:</b> Open the module to perform the following steps.<ol style="list-style-type: none"><li>Check force sensor harness connection to drive head. If necessary, reconnect harness or replace Force Sensor Assembly.<sup>①</sup></li><li>Check Syringe Size Sensor Assembly harness connection to J4 on IUI Board. If necessary, reconnect harness or replace Force Sensor Assembly.<sup>①</sup></li><li>Check Linear Sensor harness connection to J12 on Logic Board. If necessary, reconnect harness or replace Force Sensor Assembly.<sup>①</sup></li><li>Return to factory.</li></ol></div>

**Table 6-1. Technical Troubleshooting Guide (Continued)**

Message	Probable Cause	Remedy
Drive Not Engaged	<ol style="list-style-type: none"> <li>Force Sensor Assembly defective.</li> <li>Plunger head rotates due to a dislodged or broken dowel pin and/or tab in Carriage Assembly.</li> <li>Cam Lock stripped or not engaged.</li> </ol>	<ol style="list-style-type: none"> <li>Use Maintenance Software to perform Binary Switch Test and calibrate if necessary. If necessary, replace Force Sensor Assembly.<sup>①</sup></li> <li>Replace Lower Housing/Carriage Assembly.</li> <li>Rotate Actuator Knob and slide plunger head up and down, to check for full plunger head travel and Cam Lock engagement and disengagement. Repair or replace Lower Housing/Carriage Assembly if necessary.</li> <li>Return to factory.</li> </ol>
Occlusion	<ol style="list-style-type: none"> <li>Increased back pressure sensed while infusing.</li> <li>Pressure Sensor Board and/or Pressure Sensor Harness defective (Syringe Module only).</li> <li>Excessive downward pressure applied on drive head.</li> </ol>	<ol style="list-style-type: none"> <li>Check for proper set installation. Check tubing to ensure there are no obstructions (such as kinked or pinched tubing or a clogged filter).</li> <li>Perform Binary Switches Test using Maintenance Software.</li> <li>Using Maintenance Software, perform Pressure Disc Verification; calibrate if necessary. If necessary, replace Pressure Sensor Board and/or Pressure Sensor Harness.</li> <li>Use Maintenance Software to perform Plunger Force Accuracy Verification and if necessary, calibrate. Replace Force Sensor Assembly or Lower Housing/Carriage Assembly if necessary.<sup>①</sup></li> <li>Return to factory.</li> </ol>
PCA Handset Stuck (PCA Module only)	<ol style="list-style-type: none"> <li>Handset is stuck or incorrectly connected .</li> </ol>	<ol style="list-style-type: none"> <li>Verify that handset is correctly connected to PCA Module.</li> <li>Replace handset, return original to factory.</li> </ol>

Table 6-1. Technical Troubleshooting Guide (Continued)

Message	Probable Cause	Remedy
Pressure Disc Installed (Syringe Module only)	<ol style="list-style-type: none"> <li>1. Pressure sensing disc installed during an infusion.</li> <li>2. Sensor not sensing disc.</li> </ol>	<ol style="list-style-type: none"> <li>1a. Press <b>RESTART</b> key.</li> <li>1b. Check for proper pressure sensing disc installation. Disc must snap into holder.</li> <li>2. If pressure sensing disc is not installed, check binary sensor by inserting and removing disc. Use Maintenance Software to perform Binary Switches Test. Replace Pressure Sensor Board, Pressure Sensor Harness, or Flag Disk Holder if necessary.</li> <li>3. Return to factory.</li> </ol>
Pressure Disc Removed (Syringe Module only)	<ol style="list-style-type: none"> <li>1. Pressure sensing disc removed during an infusion.</li> <li>2. Sensor is sensing disc.</li> </ol>	<ol style="list-style-type: none"> <li>1a. Reinsert pressure sensing disc and press <b>RESTART</b> key.</li> <li>1b. Check for proper pressure sensing disc installation. Disc must snap into holder.</li> <li>2. If pressure sensing disc is installed, check binary sensor by inserting and removing disc. Use Maintenance Software to perform Binary Switches Test. Replace Pressure Sensor Board, Pressure Sensor Harness, or Flag Disk Holder if necessary.</li> <li>3. Return to factory.</li> </ol>
Syringe Calibration	<ol style="list-style-type: none"> <li>1. System detected Force Sensor Board, pressure disc, or Barrel Clamp requires calibration.</li> <li>2. Force Sensor Board, pressure disc, Syringe Size Sensor Assembly, or Logic Board fails calibration.</li> </ol>	<ol style="list-style-type: none"> <li>1. Use Maintenance Software to perform applicable calibration(s) or a full calibration.</li> <li>2. Replace part(s) failing calibration.<sup>①</sup> Perform applicable calibration and verification.</li> <li>3. Return to factory.</li> </ol>

**Table 6-1. Technical Troubleshooting Guide (Continued)**

Message	Probable Cause	Remedy
Syringe Drive-Head Error	<ol style="list-style-type: none"> <li>1. Syringe plunger travel impeded.</li> <li>2. Cam Lock stripped or not engaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove drivetrain blockage. If necessary, repair or replace Lower Housing/Carriage Assembly.</li> <li>2. Rotate Actuator Knob and slide plunger head up and down, to check for full plunger head travel and Cam Lock engagement and disengagement. If necessary, repair or replace Lower Housing/Carriage Assembly.</li> <li>3. Return to factory.</li> </ol>
Syringe Empty	<ol style="list-style-type: none"> <li>1. If syringe is not empty, Force Sensor Board Assembly is defective.</li> <li>2. Syringe plunger travel impeded.</li> </ol>	<ol style="list-style-type: none"> <li>1. Use Maintenance Software to perform Binary Switches Test. Replace Force Sensor Assembly or Linear Sensor if necessary.<sup>①</sup></li> <li>2. Rotate Actuator Knob and slide plunger head up and down, to check for full plunger head travel and Cam Lock engagement and disengagement. Repair or replace Lower Housing/Carriage Assembly if necessary.</li> <li>3. Return to factory.</li> </ol>
Syringe Not Recognized	<ol style="list-style-type: none"> <li>1. Odd size or wrong brand syringe installed.</li> <li>2. Syringe Size Sensor defective.</li> <li>3. Logic Board software problem.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace syringe with a compatible syringe (refer to Alaris® System DFU).</li> <li>2. Use Maintenance Software to perform Binary Switches Test. Replace Syringe Size Sensor Assembly if necessary.</li> <li>3. Replace Logic Board and flash with appropriate software version.<sup>①</sup></li> <li>4. Return to factory.</li> </ol>

<sup>①</sup> Replacing the Force Sensor Assembly or Logic Board Assembly in a module with version 7 or earlier software must be performed at the depot. Refer to the note at the beginning of this chapter for further information.

### Table 6-2. Subsystem Codes

Refer to the PC Unit / Pump Module (8000/8100 Series) Technical Service Manual for Alaris® System codes.

350	Safety System
351	Motor
352	Plunger Force
353	Plunger Position
354	Patient Pressure
355	Syringe Size
356	Digital Sensor
357	Keyboard
358	Keyboard Comm

### Table 6-3. Error Code Matrix

Refer to the PC Unit / Pump Module (8000/8100 Series) Technical Service Manual for the Alaris® System error code matrix.

6600	Motor Watchdog Test Failure
6610	Motor Watchdog Failure
6620	Syringe Size Sensor Failure
6630	Plunger Force Not Tracking Pressure
6640	Plunger Force Sensor Failure
6650	Plunger Position Sensor Failure
6660	Plunger Position Failure
6670	Pressure Disc Sensor Failure (Syringe Module only)
6680	Timebases Out of Sync
6690	Pressure Sensor Current Monitor Failure
6700	Force Sensor Circuit Test Failure
6710	Digital Sensors Illegal State
6720	Motor Step Rate Failure
6730	Motor Step Sample Too Many Steps
6740	Nut Disengaged
6750	Nut Engage Failure
6760	Not Calibrated
6770	Pressure Sensor Circuit Test Failure
6780	PCA handset stuck (PCA Module only)



**Table 6-4. Error Codes**

Refer to the PC Unit / Pump Module (8000/8100 Series) Technical Service Manual for details on accessing the Maintenance Mode and viewing the Error Log.

Error Code	Subsystem	Explanation	Response
350.6600	Logic Board	Watchdog circuit failed power-on self test.	If error is repeatable: Replace Logic Board. <sup>①</sup>
350.6630	Force Sensor	Pressure not tracked by force sensor.	If error is repeatable: Replace Force Sensor Assembly. <sup>①</sup>
350.6680	Logic Board	Timer bases; clock frequency out of sync.	If error is repeatable: Replace Logic Board. <sup>①</sup>
351.6610	Motor Watchdog	Unexpected countdown interrupt.	If error is repeatable: Replace Motor and/or Logic Board. <sup>①</sup>
351.6660	Linear Position Sensor	Movement error; predicted change in linear position sensor inconsistent with expected position.	If error is repeatable: Replace linear position sensor.
351.6720	Motor Logic Board	Motor steps accumulating too fast or too slow.	If error is repeatable: Replace Motor and/or Logic Board. <sup>①</sup>
351.6730	Motor Logic Board	Too many steps in motor step sample.	If error is repeatable: Replace Motor and/or Logic Board. <sup>①</sup>
351.6740	Engagement Nut	Nut not engaged during infusion; lever not opened.	If error is repeatable: Replace Logic Board, and/or nut engagement sensor or engagement nut. <sup>①</sup>
351.6750	Engagement Nut	Attempt to engage nut timed out before engaging.	If error is repeatable: Replace Logic Board, and/or nut engagement sensor or engagement nut. <sup>①</sup>
351.6760	Module	Calibration flag not set. Module not calibrated.	Calibrate, as required.
351.6770	Pressure Sensing Disc Logic Board (Syringe Module only)	Pressure sensing disc circuit test failed during power-on self test.	If error is repeatable: Replace pressure sensing disc and/or Logic Board. <sup>①</sup>
352.6640	Force Sensor	Force sensor output is zero or is outside acceptable range.	If error is repeatable: Replace Force Sensor Assembly. <sup>①</sup>

## TROUBLESHOOTING

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**Table 6-4. Error Codes (Continued)**

Error Code	Subsystem	Explanation	Response
352.6700	Logic Board Force Sensor	Force sensor circuit check failure.	If error is repeatable: Replace Logic Board or Force Sensor Assembly. <sup>①</sup>
353.6650	Linear Position Sensor	Linear position sensor output is zero or is outside acceptable range.	If error is repeatable: Replace linear position sensor.
354.6670	Pressure Sensing Disc (Syringe Module only)	Pressure sensor output is outside acceptable range.	Replace pressure sensing disc.
354.6690	Logic Board	Pressure Sensor current monitor: current is outside acceptable range.	If error is repeatable: Replace Logic Board or Pressure Sensor. <sup>①</sup>
355.6620	Syringe Sizer Sensor	Syringe sizer output is outside acceptable range.	If error is repeatable: Replace syringe sizer sensor.
356.6710	Digital Sensor	Digital sensor is outside acceptable range during no-power test.	If error is repeatable: Replace digital sensor.
356.6780	PCA Handset	System detected PCA Handset Key stuck at power-up.	If error is repeatable: Replace PCA Handset.

<sup>①</sup> Replacing the Force Sensor Assembly or Logic Board Assembly in a module with version 7 or earlier software must be performed at the depot. Refer to the note at the beginning of this chapter for further information.





# Chapter 7A — ILLUSTRATED PARTS BREAKDOWN

## Syringe Module

### 7.1 INTRODUCTION

The illustrated parts breakdown for the Syringe Module is divided according to its major assemblies.

### 7.2 ILLUSTRATIONS

Use the exploded views to identify the parts of each assembly. Item numbers (numbers in bubbles) in illustrations correspond to the item numbers in the parts list. A part that does not have an item number is part of a higher assembly or kit.

**NOTE:** Due to product changes over time, illustrations in this chapter may differ from the instrument under service. If there are questions, contact Cardinal Health Technical Support.

### 7.3 PARTS LIST

The parts lists include the following information for replaceable parts:

- **Item:** This number corresponds to the item number in the illustration.
- **Part Number:** Use this number to order the part. If a part number is not provided, that part is not available for sale, is part of a kit or higher assembly, or can only be replaced/repaired by Cardinal Health authorized service personnel.
- **Description:** Description of the part.
- **QTY:** Total number of each item used.

## ILLUSTRATED PARTS BREAKDOWN

### Syringe Module

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#### 7.4 ORDERING PARTS

Parts can be ordered by writing or calling Cardinal Health Customer Care (refer to "General Contract Information" page at beginning of this manual). When requesting a part, provide the following information:

- Instrument name and model number; for example, Syringe Module, Model 8110.
- Instrument software version. Refer to Alaris® System DFU for directions on how to view software version.
- Part number.
- Part description, as provided in parts list.
- For labels, specify required language.

**NOTE:** Replacing the Complete Housing Assembly, Force Sensor Assembly or Logic Board Assembly in a Syringe Module with version 7.0 or earlier software requires special calibration equipment. Until version 7.1 or later is installed in the Syringe Module, these assemblies must be replaced at the depot. Call Cardinal Health Technical Support (800.854.7128 ext. 6003) for assistance and information.

**Table 7A-1. Parts List - Syringe Module**

**NOTE:** An “assembly” is a preassembled group of parts. A “kit” is a group of unassembled parts.

Item	Part Number	Description	QTY
2	10010997	Housing Assembly, Complete <sup>①</sup> (Includes: items 3, 4, 200, 203, 205, 250, 281, 285, 461)	1
3	148189-100	Actuator Knob Assembly (Includes: items 230, 255, 265, 271, 275, 482)	1
4	148188-100	Lower Housing/Carriage Assembly Kit (Includes: Lower Housing, all Lower Housing components, Wiper Assembly, Top Plate, Carriage Assembly, and item 474)	1
5	148187-100	Leadscrew Assembly (Includes: Leadscrew, Bearing Cover Plate, Pulley, Retaining Ring)	1
6	148186-100	Motor/Pulley Assembly	1
8	10013671	Case Assembly Kit, Rear (Includes: Nameplate Label, Rear Case, and items 281, 645, 646. All items are attached except item 646.)	1
9		Case Assembly, Front:	1
	10010996	Kit <sup>③</sup> (Assembled parts: Front Case, Base Disk Holder, Flag Disk Detect Holder and Spring, Keypad, Status Indicator Lens and items 158, 281, 315, 321, 325, 326, 335, 337, 340, 342, 345, 350, 351, 355. Loose parts: items 246, 380)	
	10013911	Assembly <sup>④</sup> (Includes: Front Case, Keypad, and items 295, 345, 350, 355)	
10	147539-101	Drive Train Extrusion Frame	1
15	147768-001	Linear Sensor Assembly	1
70	147726-002	Plate, Bottom	1
85	147794-000	Bushing, Motor Isolation	8
93	321050	Grommet, Rubber	4
112	321031	Timing Belt	1
120	147537-000	Guide Rod	1
158	TC10004194 <sup>②</sup>	Collar, Park Position (Barrel Clamp)	1
200	TC10003887	Plate, Force Sensor	1
203	147815-000	Force Sensor Seal	1
205	147814-000	Lock Plate, Force Sensor	1

## ILLUSTRATED PARTS BREAKDOWN

Syringe Module

**Table 7A-1. Parts List - Syringe Module** (Continued)

Item	Part Number	Description	QTY
230	147799-001	Slide Plate	1
246	TC10003157	Flex Cable Retainer	1
250	10013882	Force Sensor Assembly Kit <sup>①</sup> (Includes: Force Sensor Assembly and item 474)	1
255	TC10003065	Knob, Actuator	1
265	147834-001	Flag, Shaft Interrupter	1
271	321041	Spring, Compression, 0.3 x 0.236 x 0.032	1
275	147836-002	Cam, Pull Rod	1
281	320763	Silicone Tubing (10 ft)	1
<b>NOTE:</b> A 10-foot length of Gasket tubing is enough for four Syringe Modules (Figures 7A-2, 7A-6, and 7A-13).			
285	TC10002873	Housing, Upper	1
295	147741-000	Status Indicator Lens	1
305	147482-104	Board Assembly, Pressure Sensor	1
307	147975-102	Harness, Pressure Sensor	1
310	147736-001	Disk Holder, Base <sup>⑤</sup>	1
315	147737-002 <sup>②</sup>	Disk Holder, Top	1
321	302513 <sup>②</sup>	Retaining Ring, External, 0.188	2
325	TC10004195 <sup>②</sup>	Barrel Clamp	1
326	321022 <sup>②</sup>	Compression Spring	1
327	10010642	Sensor Assembly, Syringe Size	1
335	147810-001 <sup>②</sup>	Potentiometer Extension Guide	1
337	321155 <sup>②</sup>	Shaft Seal	1
340	147845-002 <sup>②</sup>	Shaft Support	1
342	147987-002 <sup>②</sup>	Bushing	1
345	147847-001	Flag Seal	1
350	147846-000	Flag, Barrel Position	1
351	147882-002	Gasket, Mylar	1
355	147848-001	Leaf, Flag Spring	1
360	TC10003211	Board Assembly, Flange Detector Sensor	1



**Table 7A-1. Parts List - Syringe Module** (Continued)

Item	Part Number	Description	QTY
365	TC10003525	Board Assembly, Display	1
370	147963-100	LED Backlight Assembly, Keypad	1
373	147851-101	Harness Assembly, Display	1
375	147792-000	IUI Bracket Strap	1
380	147739-100 <sup>②</sup>	Frame, Internal	1
385	TC10003125	IUI Bracket	1
390	TC10003918	Board Assembly, Logic <sup>①</sup>	1
395	147816-105	Board Assembly, IUI Interface	1
396	806112	Snap Rivet, Black Nylon	1
397	320999	Cable Assembly, Dual End Connector	1
398	TC10003920	Retainer Clip	2
400	147791-002	IUI Support Bracket	1
410	142794-000	Foot, Rubber (use with item 499)	2
450	147795-001	Handle, Left	1
455	147796-001	Handle, Right	1
460	321033	Screw, 6-32 x <sup>7</sup> / <sub>16</sub> , PNH PHH (Zinc Plated Steel)	5
461	321100	O-Ring, 0.07 x 0.07, 40 Durometer	4
462	321060	Screw, M2.5 x 12, PHH CHSE HD	4
474	10013293	Screw, 2-56 x <sup>3</sup> / <sub>16</sub> , Socket Head Cap, Nylok	4
478	148225-000	Screw, 4-20 x 1, Socket Cap Trifast	4
480	303655	Screw, 4-20 x <sup>5</sup> / <sub>16</sub> , Trilob PNH PHH	1
482	300345	Screw, 4-40 x <sup>1</sup> / <sub>4</sub> , PNH PHH (Zinc Plated Steel)	1
484	301711	Screw, 4-40 x <sup>3</sup> / <sub>16</sub> , PNH PHH	2
486	300926	Screw, 4-40 x <sup>5</sup> / <sub>16</sub> , PNH PHH (Zinc Plated Steel)	14
488	301708	Screw, 6-32 x <sup>5</sup> / <sub>16</sub> , PNH PHH	3
490	320855	Screw, 6-32 x <sup>7</sup> / <sub>16</sub> , PNH PHH (Stainless Steel)	7
491	320729	Washer, #5 (Stainless Steel)	3
492	320851	Screw, 4-40 x <sup>5</sup> / <sub>16</sub> , PNH PHH (Stainless Steel)	3
494	320167	Washer, 0.125 x 0.312 x 0.032 (Stainless Steel)	1

## ILLUSTRATED PARTS BREAKDOWN

Syringe Module

**Table 7A-1. Parts List - Syringe Module** (Continued)

Item	Part Number	Description	QTY
496	321035	Screw, 4-40 x 3/4, PNH PHH	6
499	⑥	Silicone Grease, Dow Corning Molykote 33, or equivalent (use with item 410)	As required
645	148013-000	Label, Patent	1
646	125569	Label, Serial Number Replacement	1
2003	147077-100	IUI Connector Kit, Right (Includes: Right Gasket, Right IUI Connector)	1
2004	147078-100	IUI Connector Kit, Left (Includes: Left Seal, Left IUI Connector)	1
2006	147080-100	Latch Kit (Includes: Latch, Compression Spring, Leaf Spring, Support)	1
		Directions for Use:	1
	10010720	PCA Module (V7)	
	10010199	Syringe Module (V7)	
		Alaris® System (supports Guardrails® Suite MX):	
	10012555	Electronic Copy	
	10012398	Printed Copy	
	148089-001	Set Compatibility Card	1

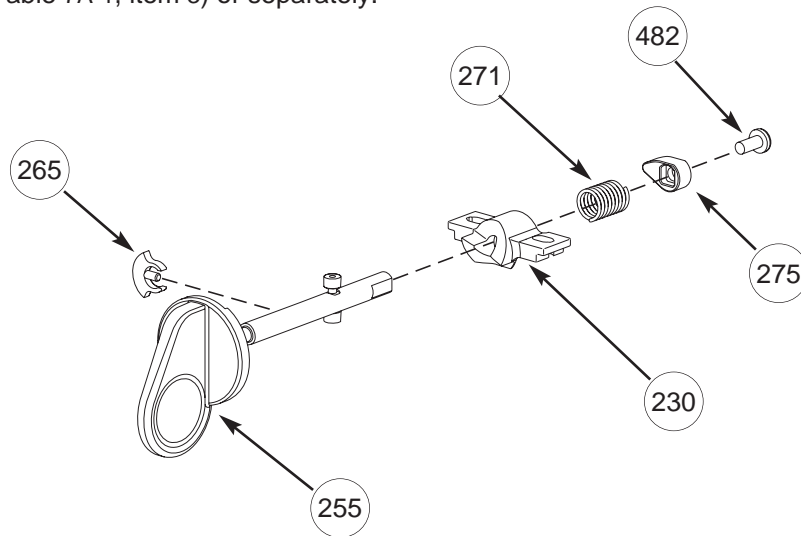
① Replacement of the Complete Housing Assembly, Force Sensor Assembly or Logic Board Assembly in a Syringe Module with version 7 or earlier software must be performed at the depot. Refer to the note in section 7.4 for further information.

### ② CAUTIONS

- The Top disk Holder, Internal Frame, Shaft Support and various Syringe Barrel Clamp Assembly parts identified here are not backwards compatible with a Syringe Barrel Clamp Assembly having a Park Position “Pin” attached. Prior to ordering any of these parts, reference the “Corrective Maintenance” chapter for part identification and replacement instructions.
  - Newer versions of the Park Position Collar and Barrel Clamp are not interchangeable with earlier versions. If either part requires replacement and the hex head bit, 1/16 HX, 1 15/16” length tool was used to remove the Park Position Collar 0.062” setscrew, both parts must be replaced.
- ③ Order the Front Case “Kit” when replacing an “old version” Front Case, Syringe Barrel Clamp Assembly (or associated part), or Top Disk Holder (reference Figure 7A-7).
- ④ Order the Front Case “Assembly” when replacing a “new version” Front Case, Syringe Barrel Clamp Assembly (or associated part), or Top Disk Holder (reference Figure 7A-7).
- ⑤ The Base Disk Holder can be relaced as an individual part only if it is used with a “new version” Front Case. If an “old version” Front Case is in use, order item 9, Front Case “Kit” (reference Figure 7A-7).
- ⑥ Not sold by Cardinal Health.

**Figure 7A-1. Actuator Knob Assembly**

1 Actuator Knob Assembly items are available as an assembly (Table 7A-1, item 3) or separately.



## ILLUSTRATED PARTS BREAKDOWN

### Syringe Module

**Figure 7A-2. Housing Assembly**

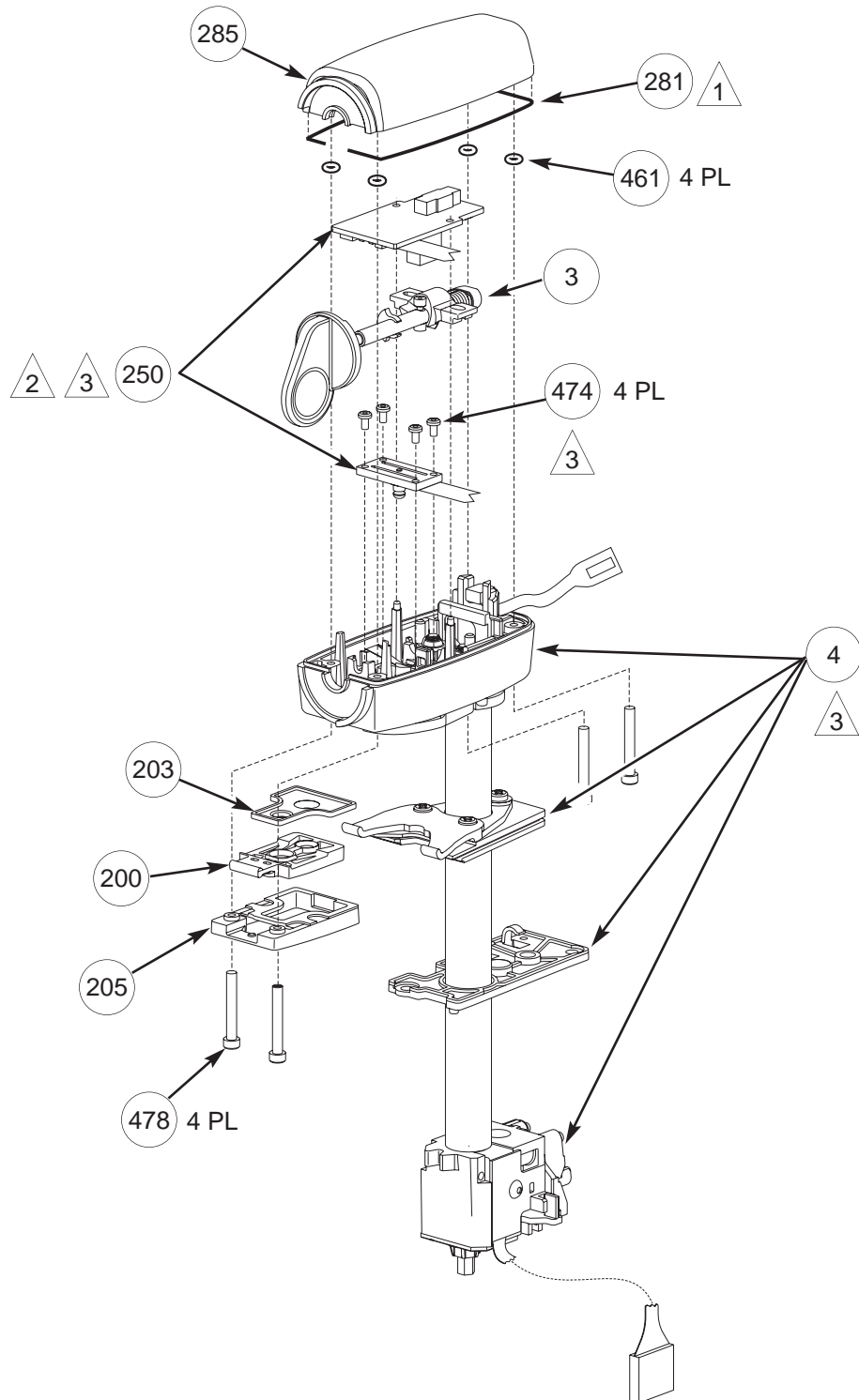
1 Install 6½" Gasket (item 281) around parameter, and into undercut feature, of Upper Housing (item 285). Gasket is not to overlap into opening for Actuator Knob Assembly (item 3).

2 Replacement of the Force Sensor Assembly in a Syringe Module with version 7 or earlier software must be performed at the depot. Refer to section 7.4 for further information.

3 Nylok screws (item 474) are provided as part of Lower Housing/ Carriage Assembly Kit (item 4) and Force Sensor Assembly (item 250).

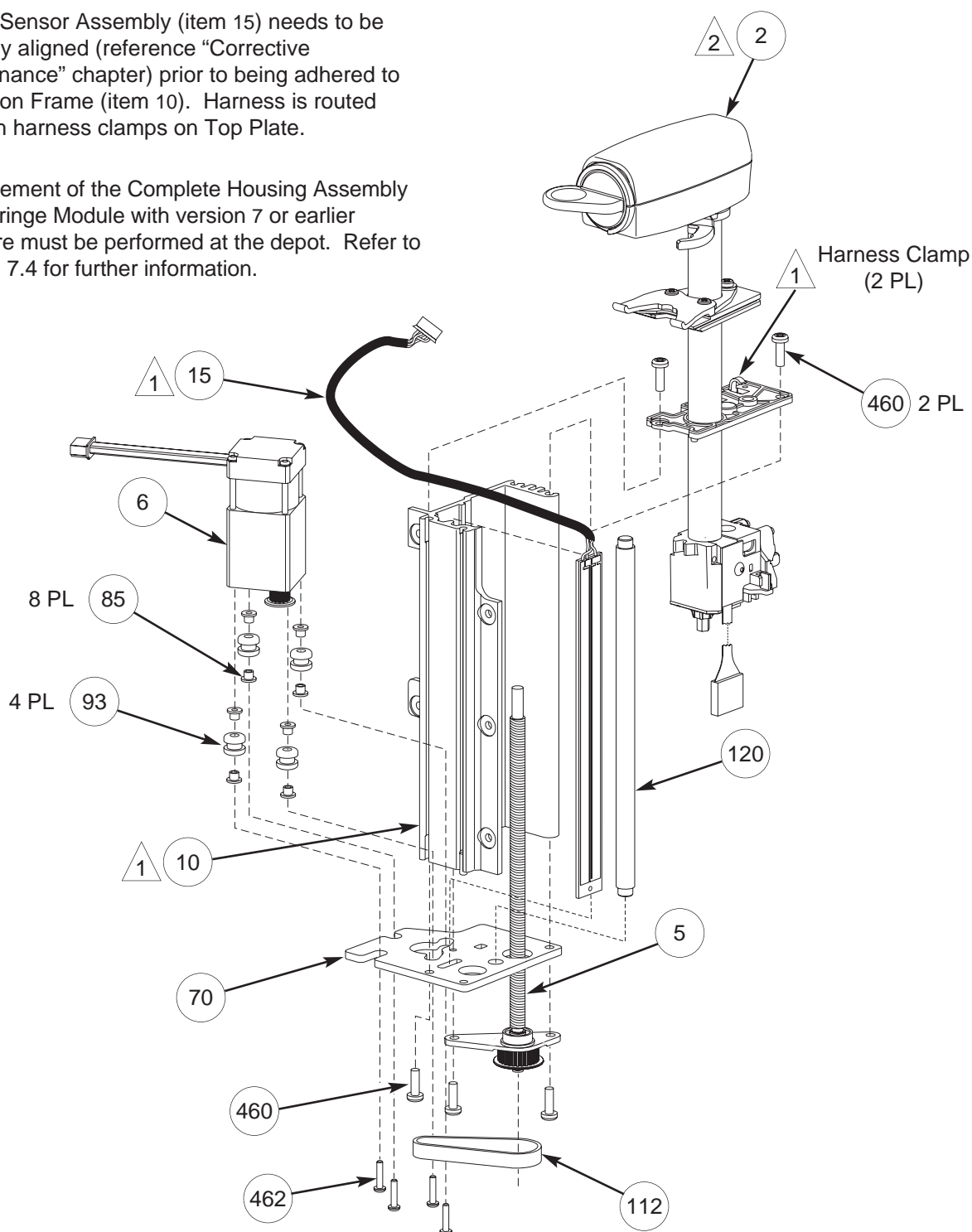
#### CAUTION

To avoid damaging Lower Housing (part of item 4), use Nylok screws (item 474) to install Force Sensor Assembly (item 250).



1 Linear Sensor Assembly (item 15) needs to be properly aligned (reference “Corrective Maintenance” chapter) prior to being adhered to Extrusion Frame (item 10). Harness is routed through harness clamps on Top Plate.

**2** Replacement of the Complete Housing Assembly in a Syringe Module with version 7 or earlier software must be performed at the depot. Refer to section 7.4 for further information.



## ILLUSTRATED PARTS BREAKDOWN

Syringe Module

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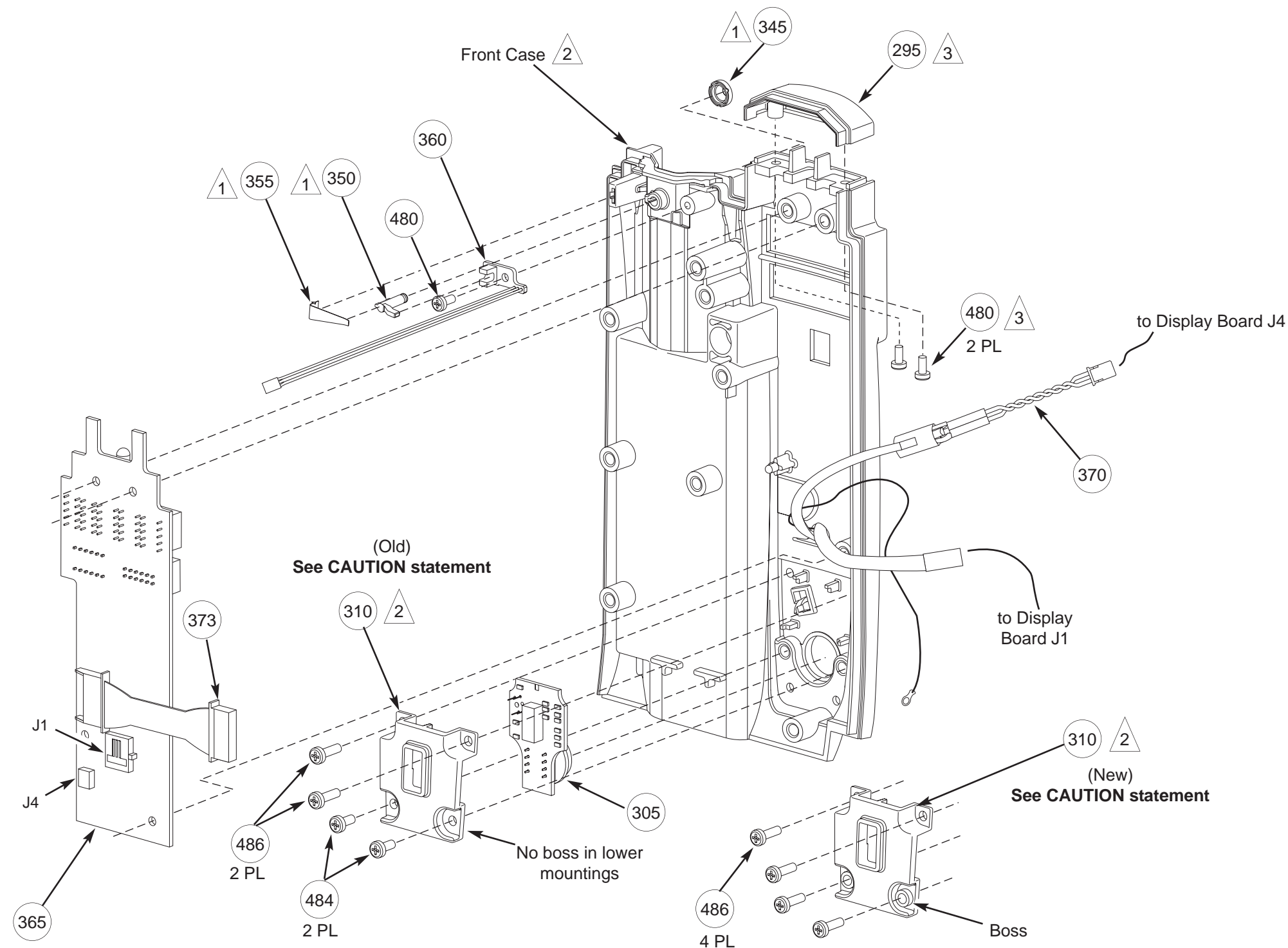
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Figure 7A-4. Front Case Assembly - Part 1

**CAUTION**

To avoid damage to the Front Case when installing the Base Disk Holder, ensure correct screws are used.

- △1 Flag Seal (item 345), Barrel Position Flag (item 350), and Flag Spring Leaf (item 355) are provided separately and also as assembled items in Front Case “Assembly” and “Kit” (Table 7A-1, item 9).
- △2 If Front Case or Base Disk Holder (item 310) require replacement, reference Table 7A-1 item 9 or 310, and Figure 7A-7 for part replacement requirements.
- △3 Status Indicator Lens (item 295) is provided separately and is also an assembled item in Front Case “Assembly” and “Kit” (Table 7A-1, item 9).



ILLUSTRATED PARTS BREAKDOWN

Syringe Module

Figure 7A-5. Front Case Assembly - Part 2

CAUTIONS

- When replacing any Syringe Barrel Clamp Assembly parts and a Park Position “Pin” (versus a “Collar”) is installed, replace with Front Case Assembly Kit (Table 7A-1, item 9; Figure 7A-8).
- Newer versions of the Park Position Collar and Barrel Clamp are not interchangeable with earlier versions. If either part requires replacement and the hex head bit, 1/16 HX, 1<sup>15</sup>/<sub>16</sub>” length tool was used to remove the Park Position Collar 0.062” setscrew, both parts must be replaced.

1 Reference “Corrective Maintenance” chapter, “Removing Syringe Barrel Clamp Assembly” section, for Shaft Seal (item 337) installation instructions.

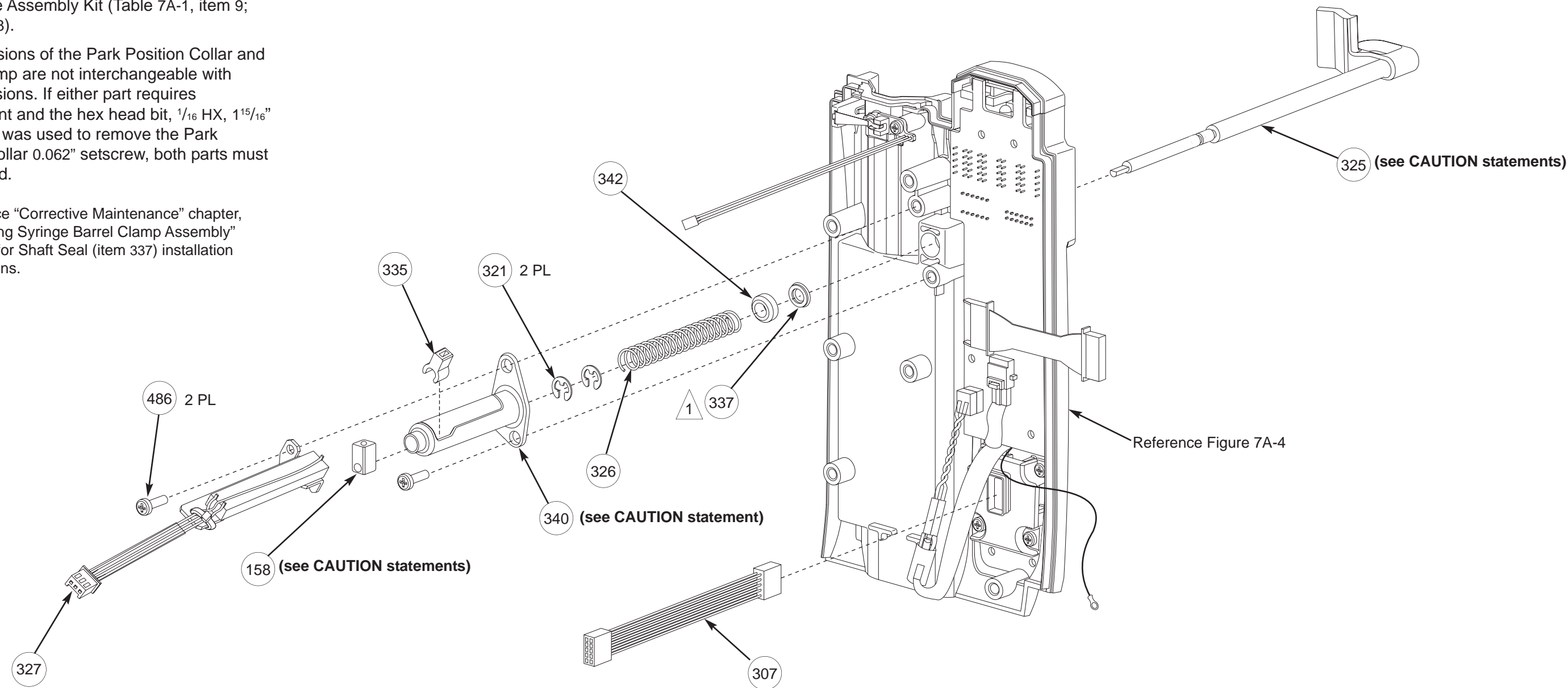




Figure 7A-6. Top Disk Holder - Front Case Assembly

**CAUTION**

The Top Disk Holder illustrated here is not backward compatible with older versions of the Front Case Assembly. Prior to replacing this part, reference the “Corrective Maintenance” chapter and Figure 7A-7 for replacement instructions and part identification.

**NOTE:** All parts illustrated in this figure are provided separately and as assembled items in the Front Case Assembly Kit (Table 7A-1, item 9).

- 1 Install 4½” Gasket (item 281) into channel on Front Case.
- 2 Spring (item 312) torque is set by inserting end of spring in hole of Flag Disk Holder (item 311) and winding holder counterclockwise.

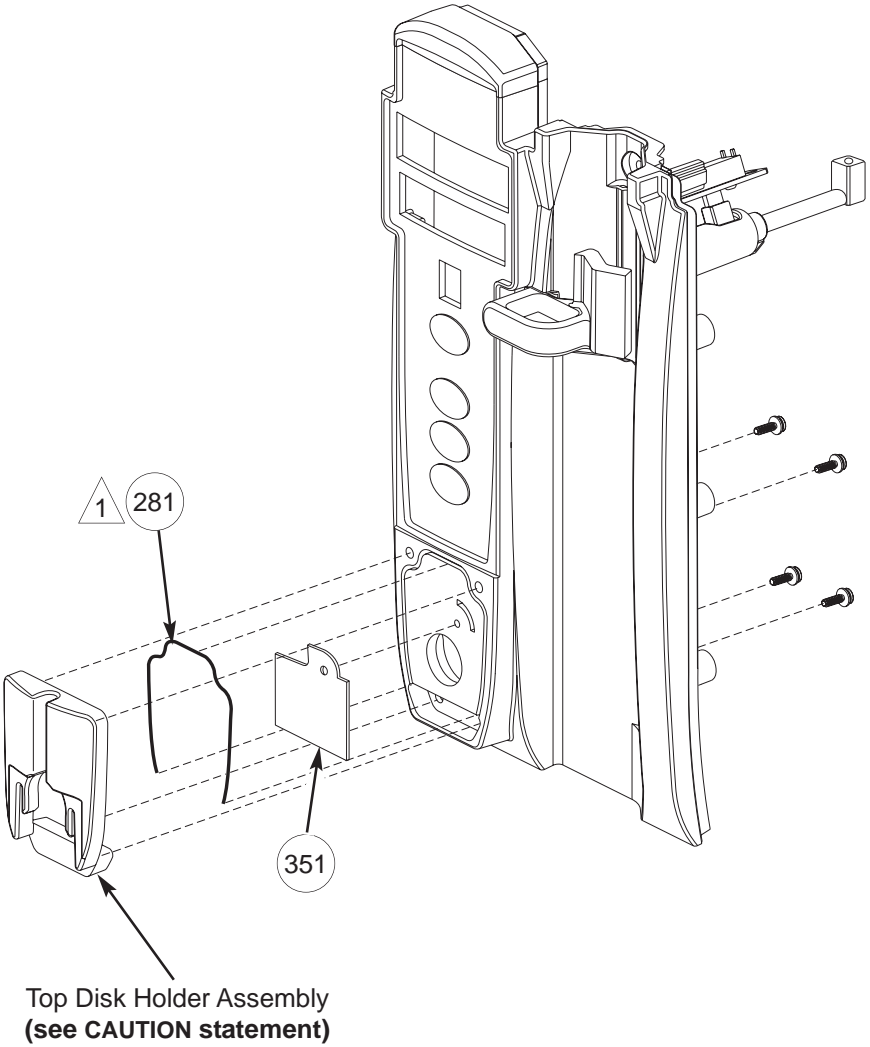
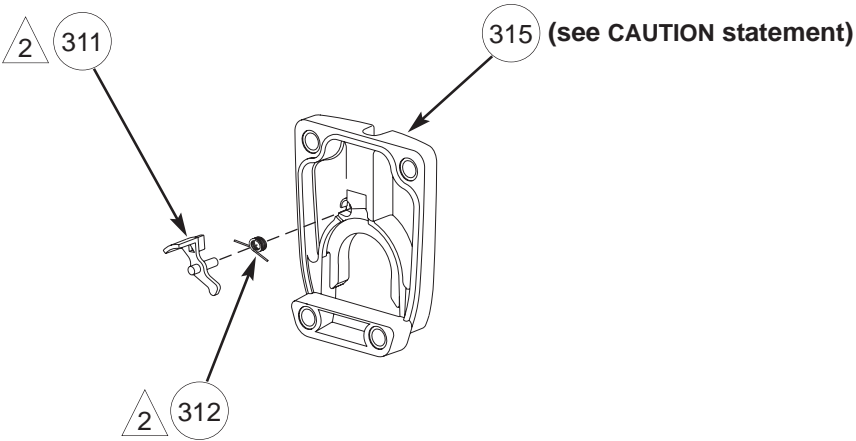
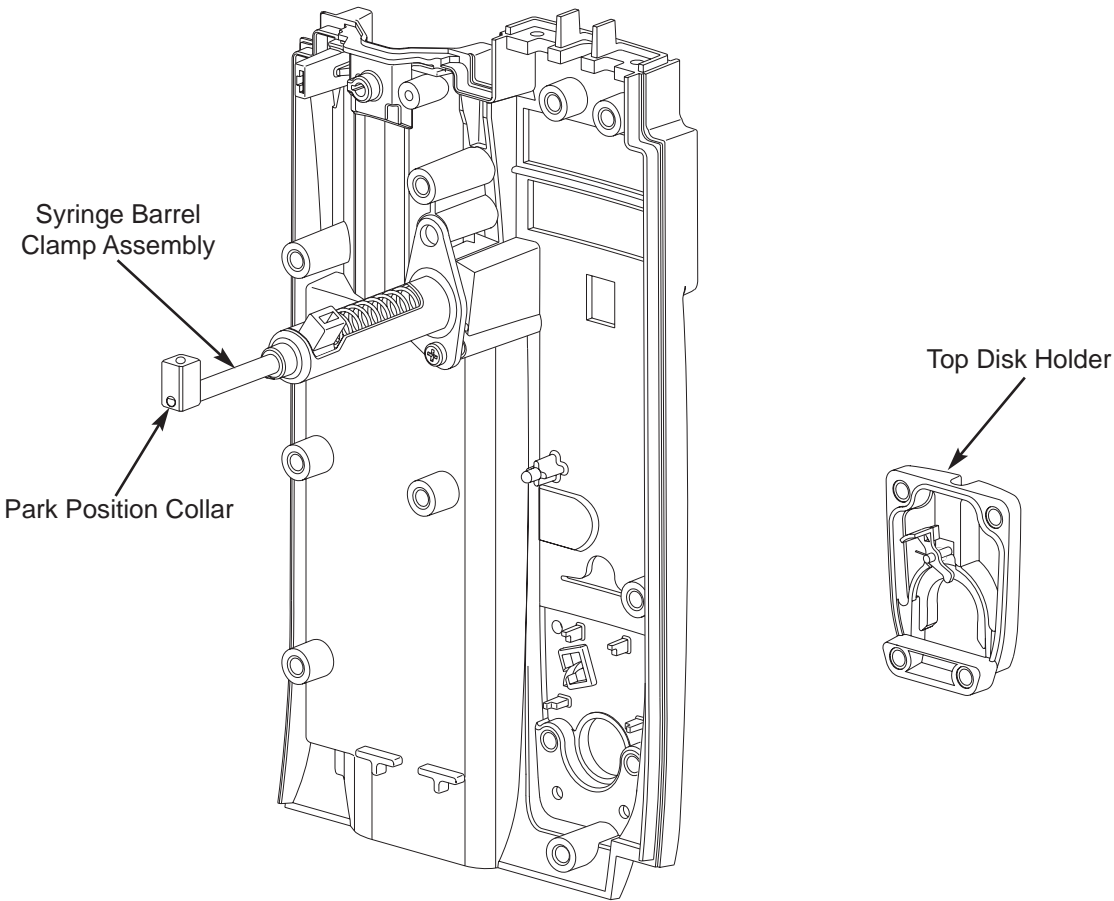


Figure 7A-7. Front Case, Syringe Barrel Clamp Assembly, Top Disk Holder -- Interchangeability

New Version

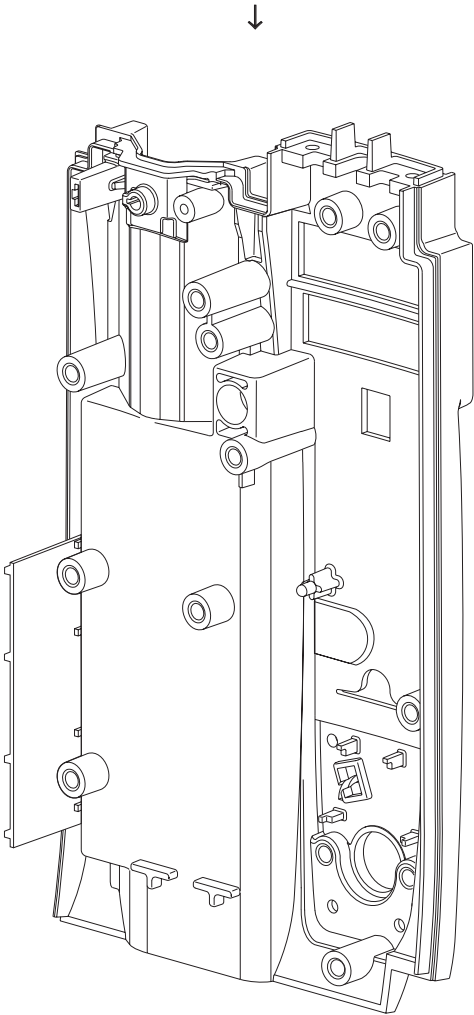
This figure illustrates a newer version of the Front Case, Syringe Barrel Clamp Assembly and Top Disk Holder. These parts are not backwards compatible with older versions of parts (reference figure to right).



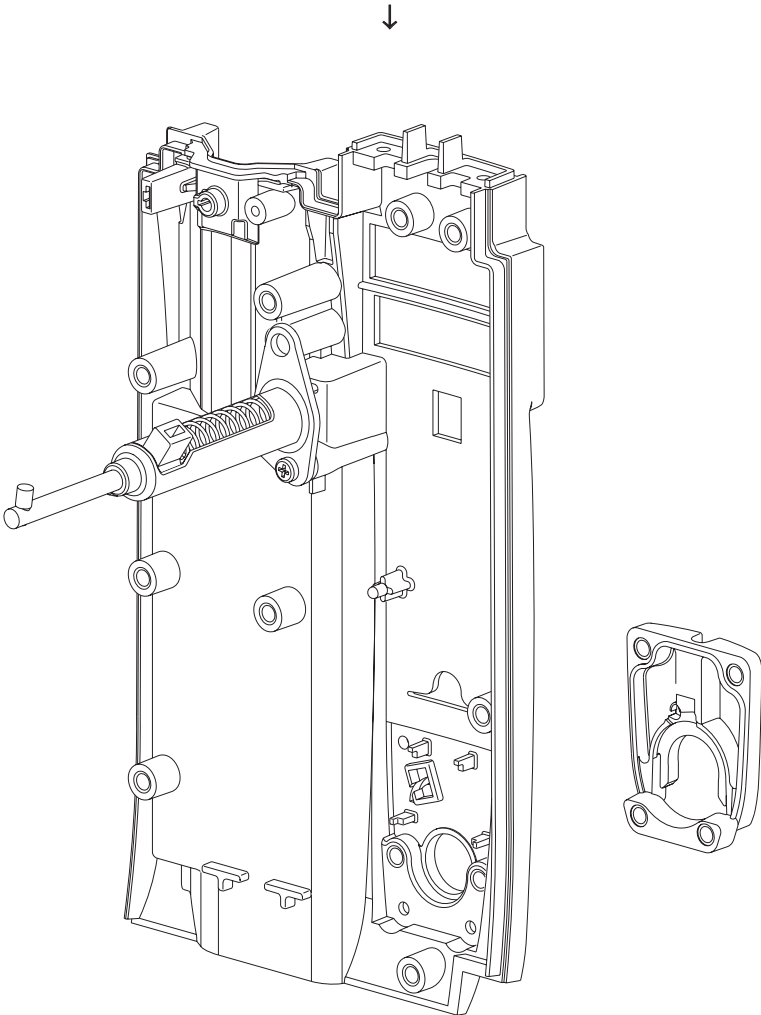
Old Versions

These figures illustrate older versions of the Front Case, Syringe Barrel Clamp Assembly and Top Disk Holder.

The newer version of Top Disk Holder (reference figure to left) can be used with the Front Case illustrated below. If the Front Case requires replacement, it must be replaced with the Front Case Assembly "Kit" (Table 7A-1, item 9).

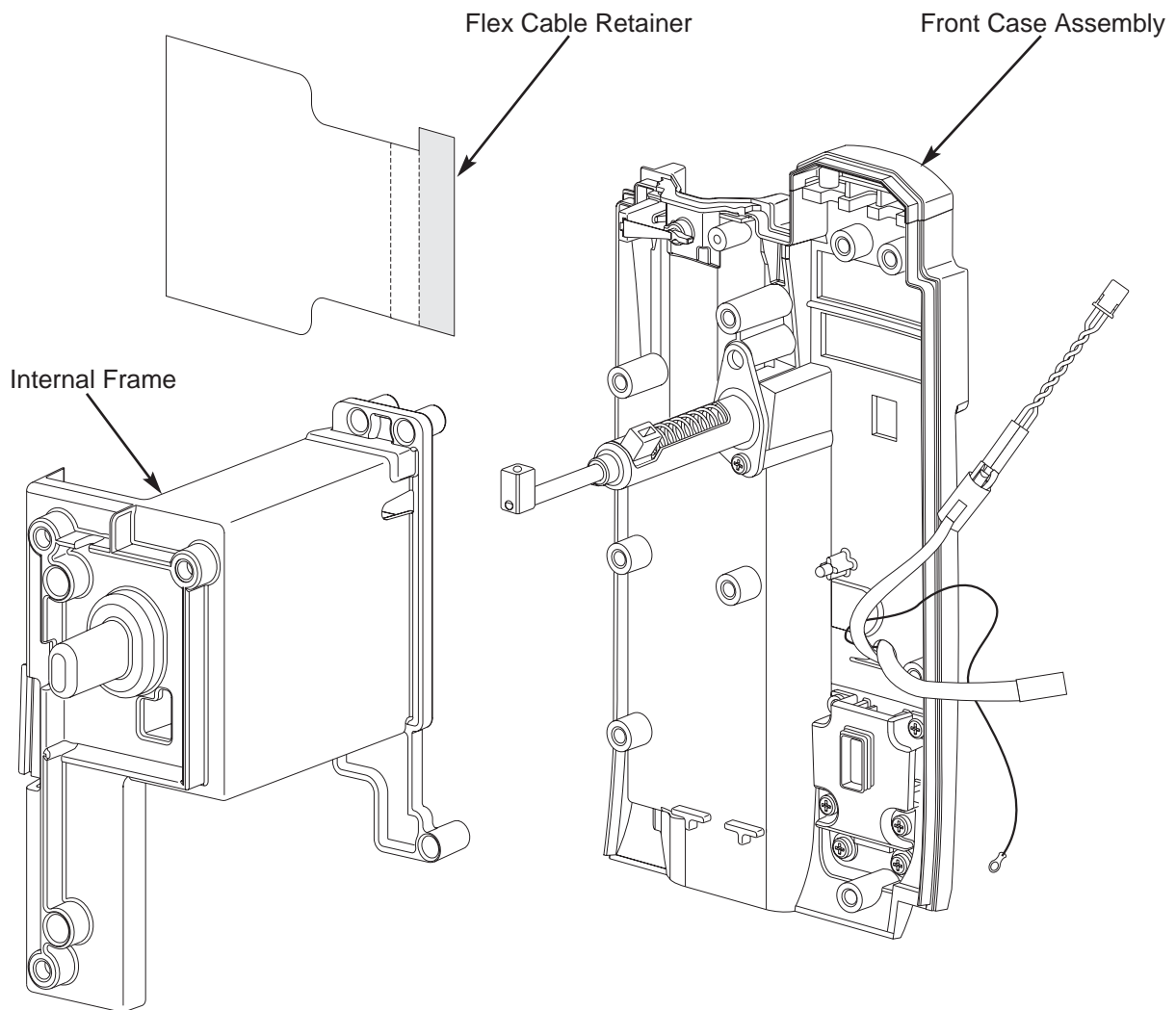


If the Front Case, Syringe Barrel Clamp Assembly (or an associated part) or Top Disk Holder illustrated below require replacement, they must be replaced with the Front Case Assembly "Kit" (Table 7A-1, item 9).



**Figure 7A-8. Front Case Assembly Kit****NOTES:**

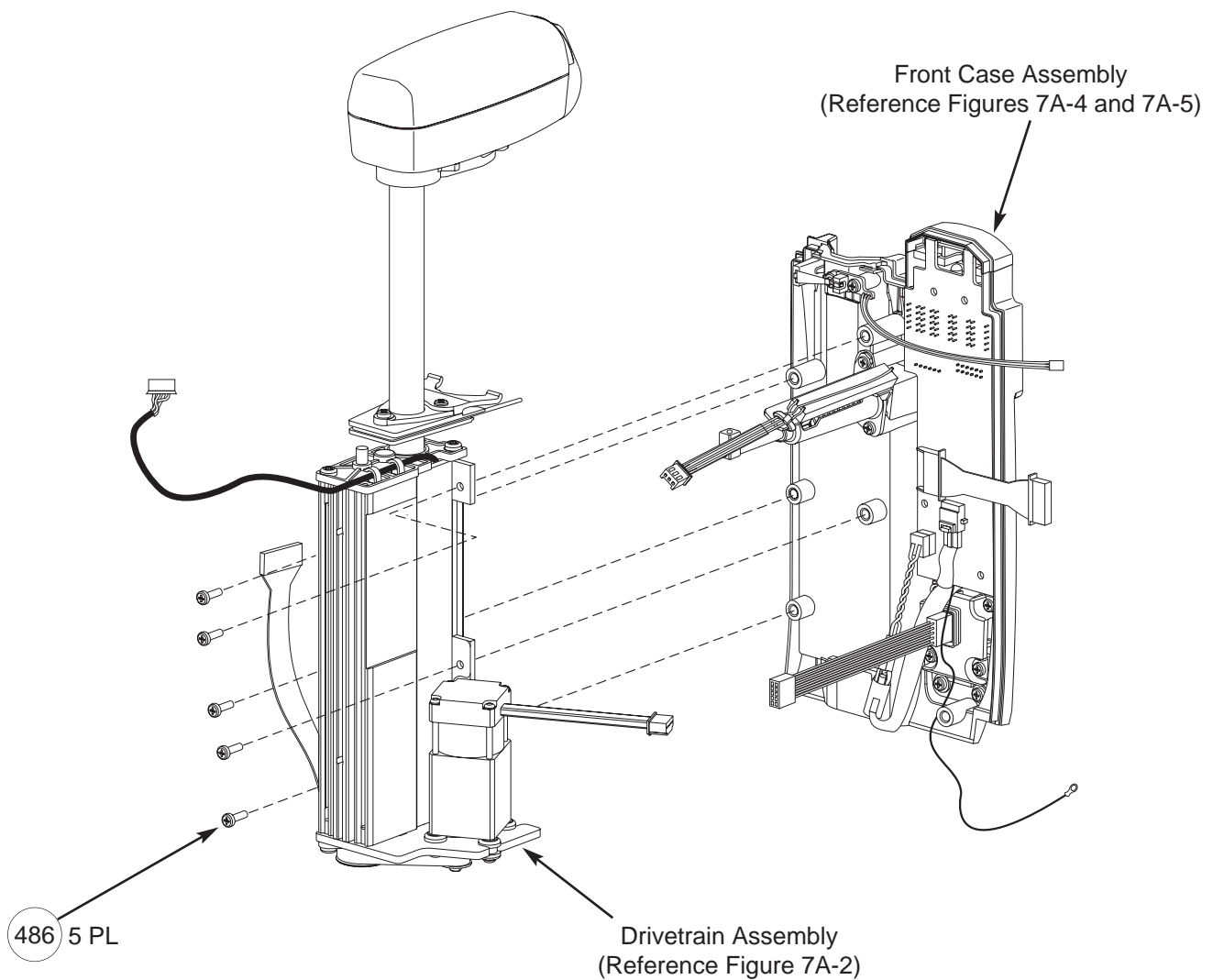
- Reference Table 7A-1, item 9, for a list of parts that make up the Front Case Assembly (as provided in “Kit”).
- When installing the Front Case Assembly, remove and reuse the existing Pressure Sensor Board Assembly (reference “Corrective Maintenance” chapter).
- If a Flex Cable Retainer is not already installed, install Flex Cable Retainer provided in kit (reference Figure 7A-12).



## ILLUSTRATED PARTS BREAKDOWN

Syringe Module

**Figure 7A-9. Drivetrain Assembly - Front Case Assembly**

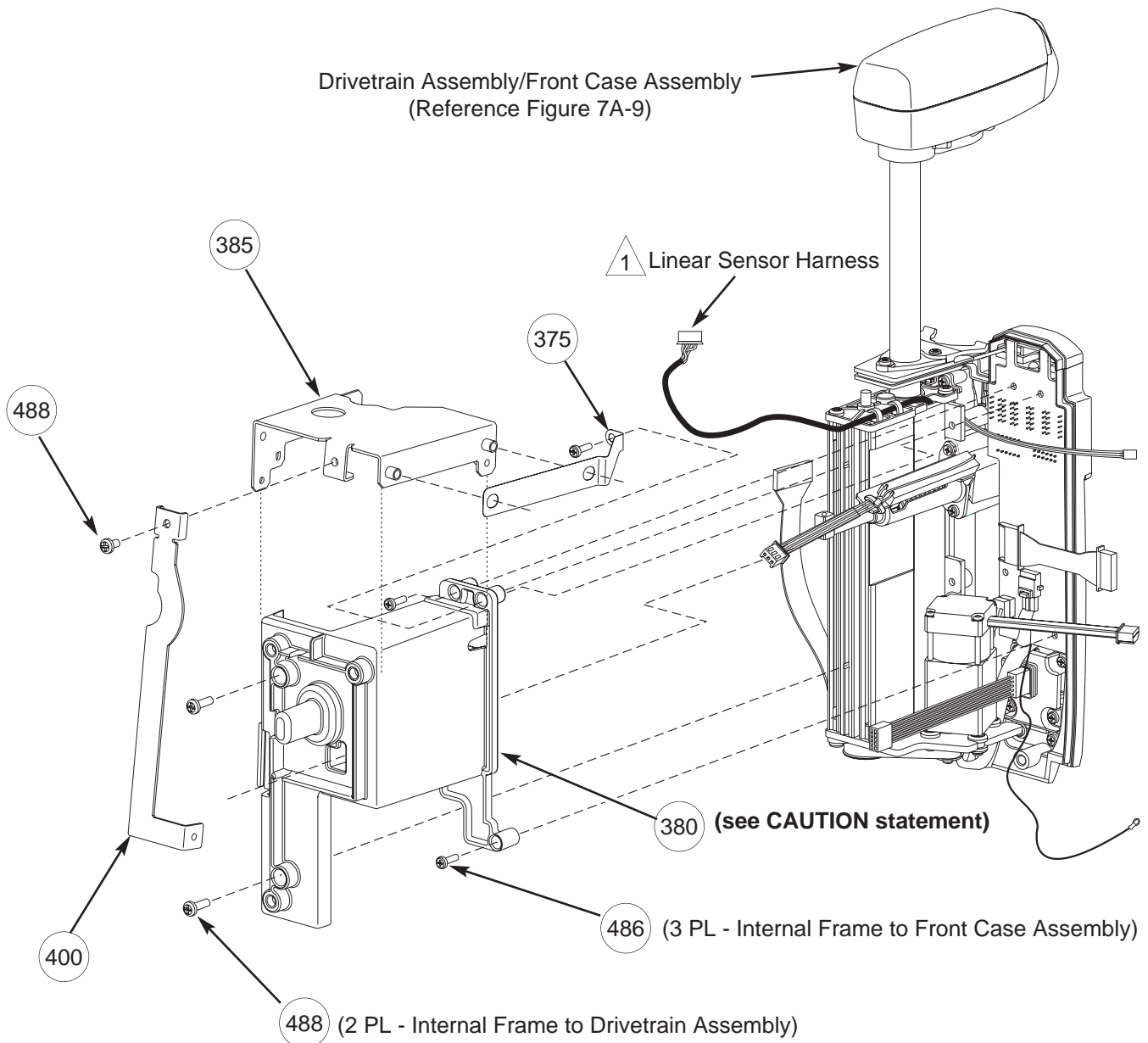


**Figure 7A-10. Internal Frame Assembly - Front Case Assembly****CAUTION**

Prior to replacing the Internal Frame, reference the “Corrective Maintenance” chapter for interchangeability information and replacement instructions.



Linear Sensor Harness (part of Drivetrain Assembly) is routed between UII Bracket (item 385) and Internal Frame (item 380), and beneath UII Support Bracket (item 400) from left to right.

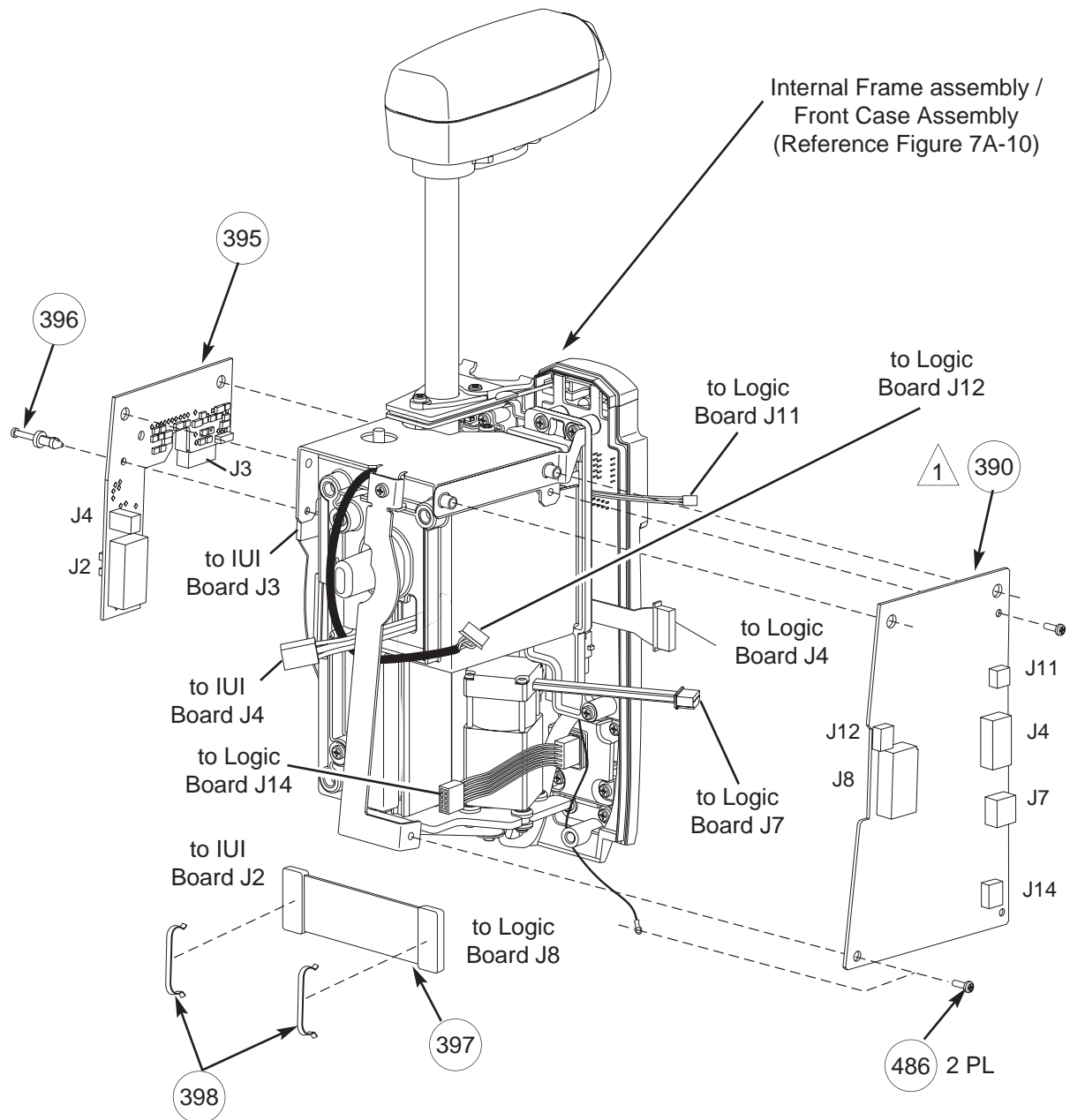


## ILLUSTRATED PARTS BREAKDOWN

Syringe Module

**Figure 7A-11. Logic Board and UI Board Assemblies**

- 1 Replacement of the Logic Board Assembly in a Syringe Module with version 7 or earlier software must be performed at the depot. Refer to section 7.4 for further information.



**Figure 7A-12. Flex Cable Retainer Assembly**

- 1 Flex Cable Retainer (item 246) is provided as a separate item and as part of Front Case Assembly Kit (Table 7A-1, item 9; Figure 7A-8).
- 2 If necessary, bend Flex Cable Retainer on each fold line at a 90° angle, toward front of instrument. Lay retainer over Flex Cable and tuck inside edge of Front Case (reference illustration to right).

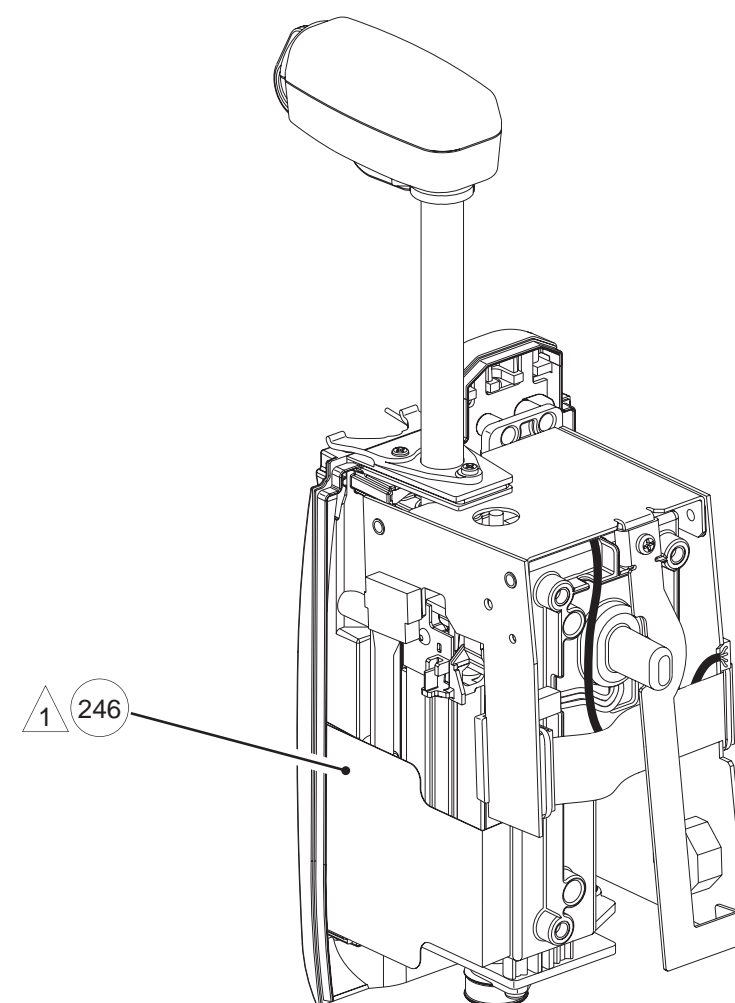
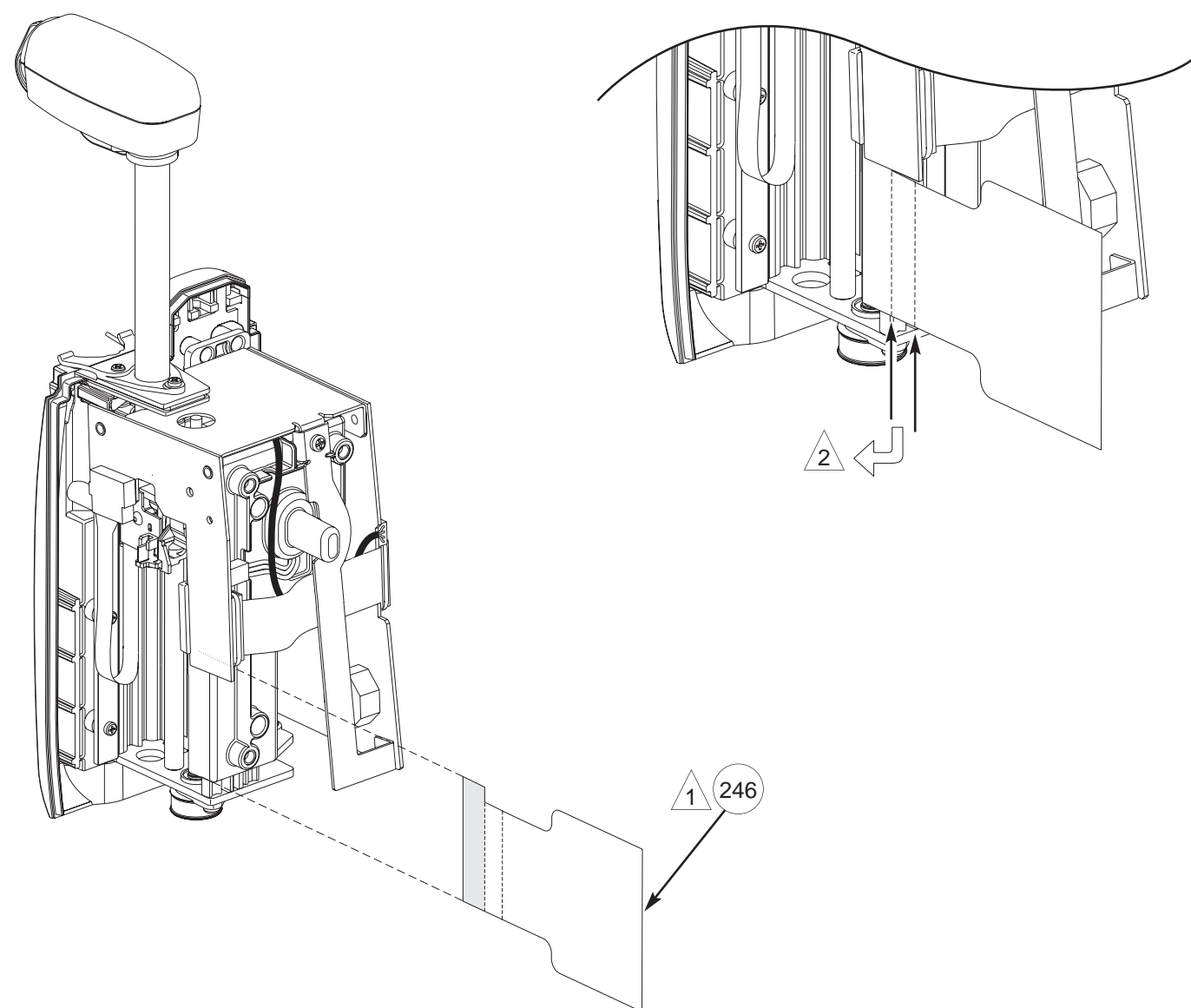


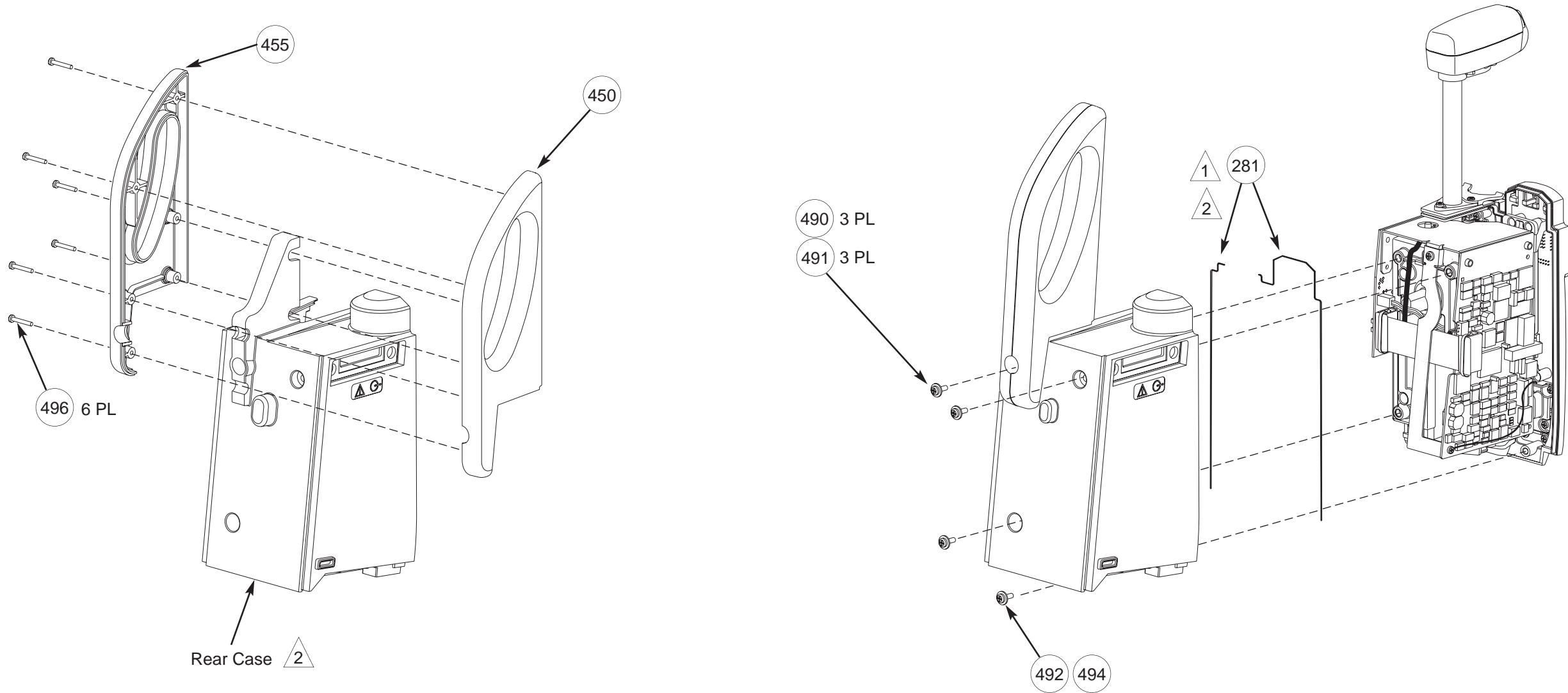


Figure 7A-13. Final Assembly

- 1

Install two Gasket (item 281) pieces, approximately 7½" and 10½", into channel on Rear Case.
- 2

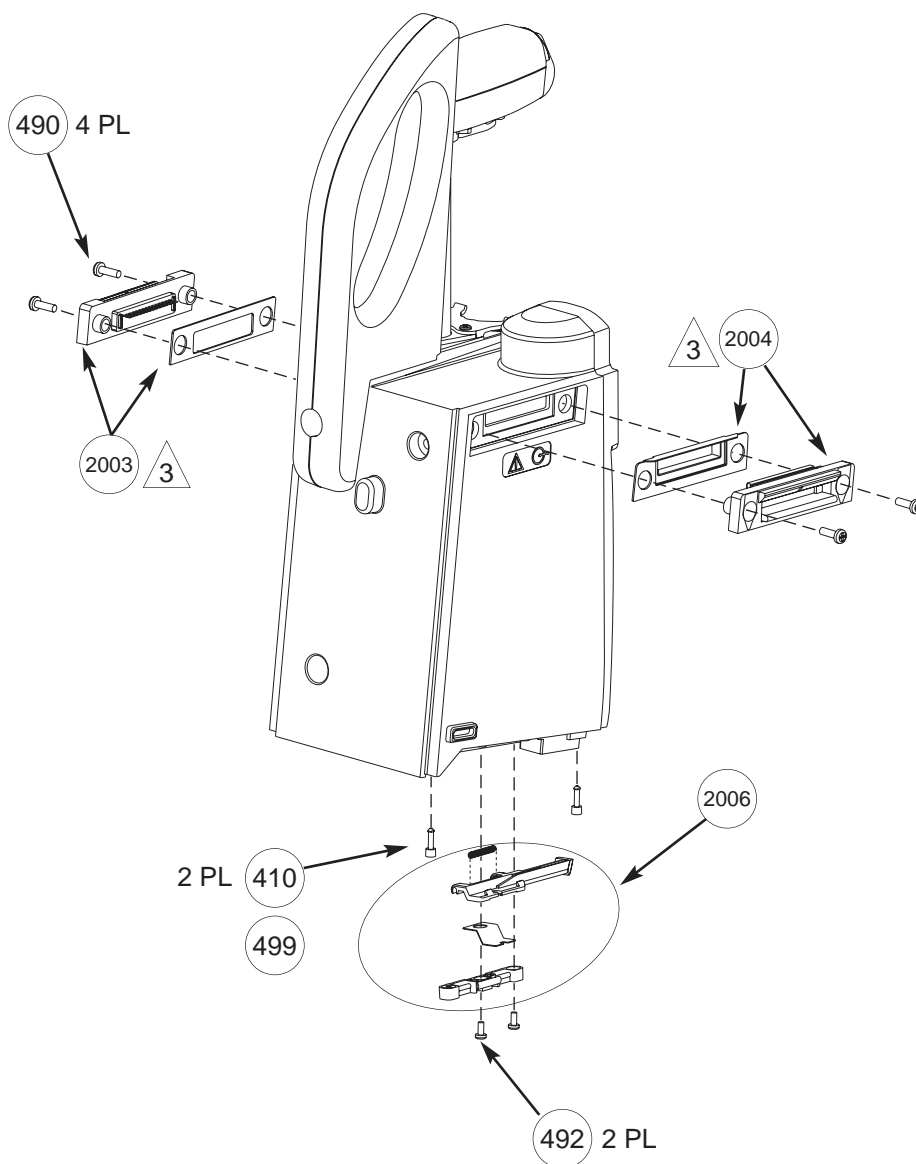
Rear Case and Silicone Tubing gasket (item 281) are provided as separate items and as part of Rear Case Assembly Kit (item 8). Reference Table 7A-1, item 8 for a list of parts included in Rear Case Assembly Kit.





**Figure 7A-13. Final Assembly (Continued)**

△ 3 Do not mix gray (old) and black (new) IUI Connectors.



## ILLUSTRATED PARTS BREAKDOWN

Syringe Module

**Figure 7A-14. Rear Label Locations**

- 1 Labels (items 645 and 646) are provided as separate items and as part of Rear Case Assembly Kit. Reference Table 7A-1, item 8 for a list of parts included in Rear Case Assembly Kit.
- 2 Nameplate Label is available only as part of Rear Case Assembly Kit. This label has a regulatory mark, and any level of service that requires its replacement must be performed at the factory.
- 3 Before adhering Serial Number Label (item 646):

  1. Print instrument model and serial number on label in permanent black ink.
  2. Apply clear overlay to completely cover label.

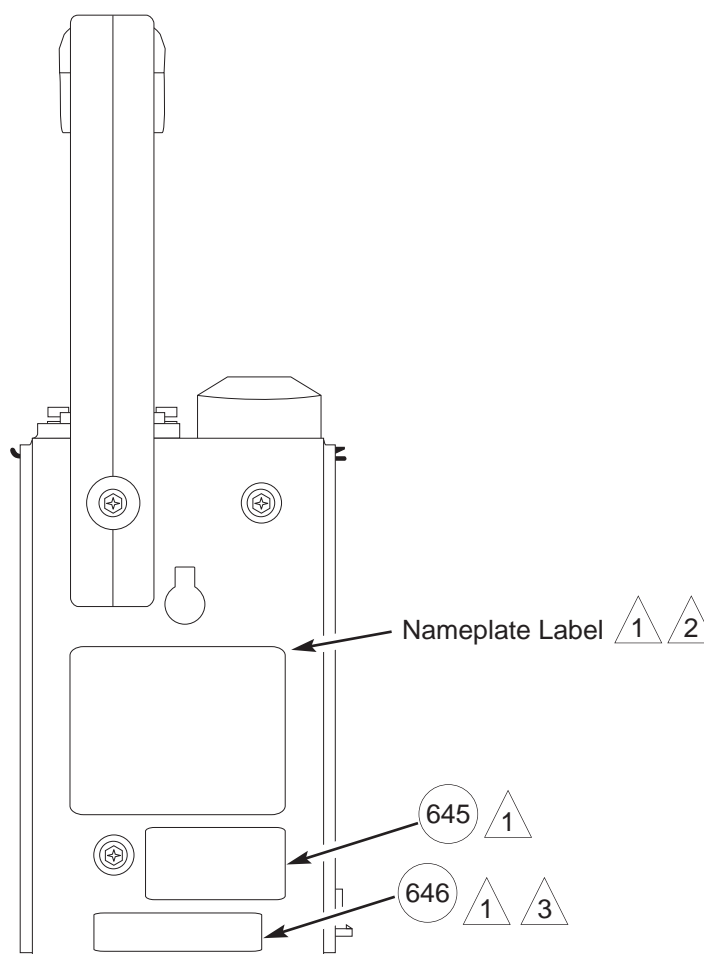
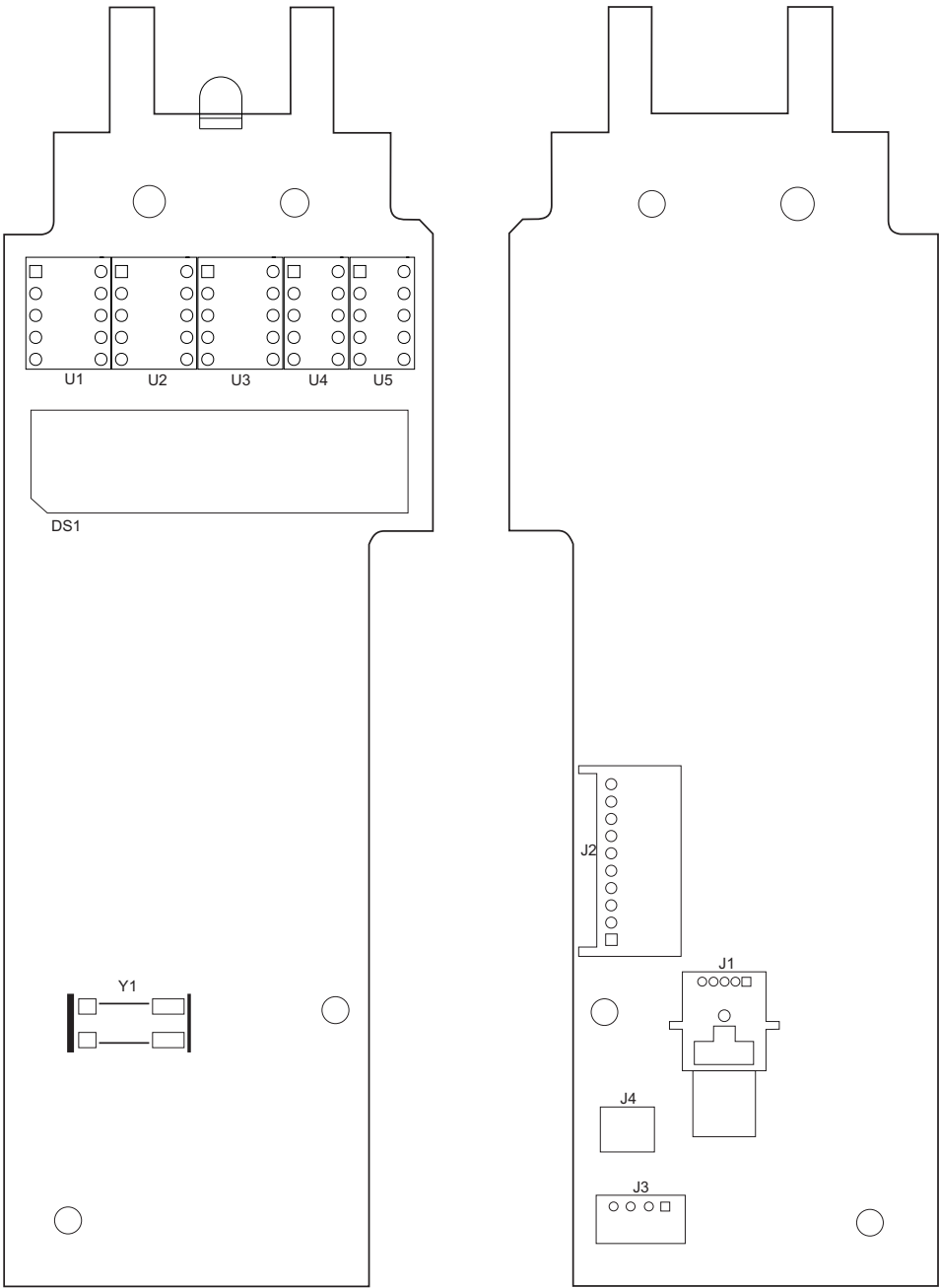


Figure 7A-15. Display Board Assembly

**NOTE:** This illustration is for board identification purposes only and does not represent the board's component layout.



## ILLUSTRATED PARTS BREAKDOWN

Syringe Module

**Figure 7A-16. IUI Interface Board Assembly**

**NOTE:** This illustration is for board identification purposes only and does not represent the board's component layout.

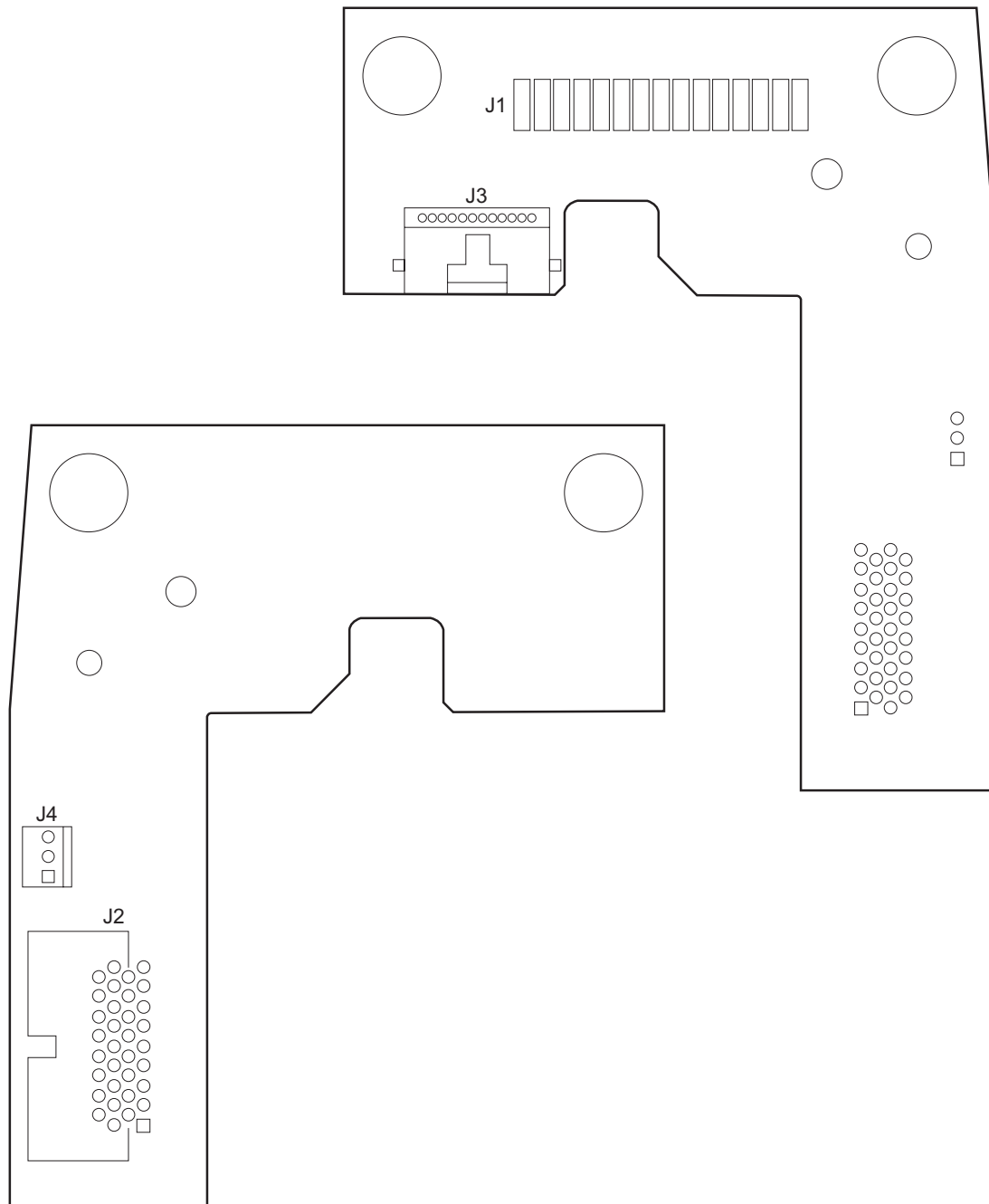
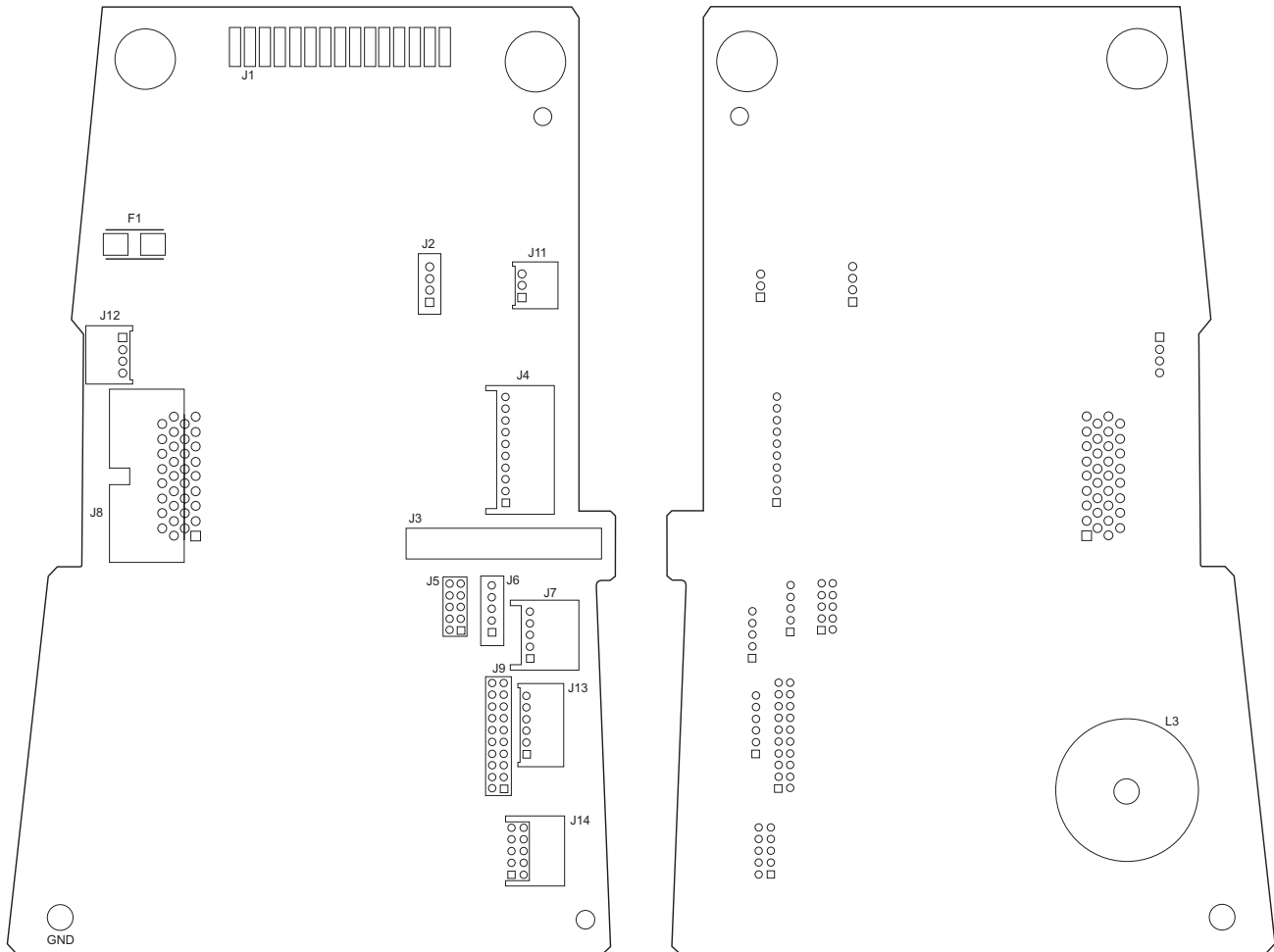


Figure 7A-17. Logic Board Assembly

**NOTE:** This illustration is for board identification purposes only and does not represent the board's component layout.



## ILLUSTRATED PARTS BREAKDOWN

Syringe Module

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## 7.1 INTRODUCTION

The illustrated parts breakdown for the PCA Module is divided according to its major assemblies.

## 7.2 ILLUSTRATIONS

Use the exploded views to identify the parts of each assembly. Item numbers (numbers in bubbles) in the illustrations correspond to the item numbers in the parts list. A part that does not have an item number is part of a higher assembly or kit.

**NOTE:** Due to product changes over time, illustrations in this chapter may differ from the instrument under service. If there are questions, contact Cardinal Health Technical Support.

## 7.3 PARTS LIST

The parts lists include the following information for replaceable parts:

- **Item:** This number corresponds to the item number in the illustration.
- **Part Number:** Use this number to order the part. If a part number is not provided, that part is not available for sale, is part of a kit or higher assembly, or can only be replaced/repaired by Cardinal Health authorized service personnel.
- **Description:** Description of the part.
- **QTY:** Total number of each item used.

## ILLUSTRATED PARTS BREAKDOWN

### PCA Module

#### 7.4 ORDERING PARTS

Parts can be ordered by writing or calling Cardinal Health Customer Care (refer to "General Contract Information" page at beginning of this manual). When requesting a part, provide the following information:

- Instrument name and model number; for example, Syringe Module, Model 8110.

- Instrument software version. Refer to Alaris® System DFU for directions on how to view software version.
- Part number.
- Part description, as provided in parts list.
- For labels, specify required language.

**Table 7B-1. Parts List - PCA Module**

**NOTE:** An "assembly" is a preassembled group of parts. A "kit" is a group of unassembled parts.

Item	Part Number	Description	QTY
2	10010997	Housing Assembly, Complete (Includes: items 3, 4, 200, 203, 205, 250, 281, 285, 461)	1
3	148189-100	Actuator Knob Assembly (Includes: items 230, 255, 265, 271, 275, 482)	1
4	148188-100	Lower Housing/Carriage Assembly Kit (Includes: Lower Housing, all Lower Housing components, Wiper Assembly, Top Plate, Carriage Assembly and item 474)	1
5	148187-100	Leadscrew Assembly (Includes: Leadscrew, Bearing Cover Plate, Pulley, Retaining Ring)	1
6	148186-100	Motor/Pulley Assembly	1
8	10013672	Case Assembly Kit, Rear (Includes: Rear Case, Nameplate Label, and items 281, 645, 646. All items are attached except item 646.)	1
9	10013531	Case Assembly, Front (Includes: Front Case, Keypad, and items 295, 345, 350, 355.)	1
10	147539-101	Drive Train Extrusion Frame	1
15	147768-001	Linear Sensor Assembly	1
70	147726-002	Plate, Bottom	1
85	147794-000	Bushing, Motor Isolation	8
93	321050	Grommet, Rubber	4
112	321031	Timing Belt	1
120	147537-000	Guide Rod	1
158	TC10004194 <sup>①</sup>	Collar, Park Position (Barrel Clamp)	1

**Table 7B-1. Parts List - PCA Module** (Continued)

Item	Part Number	Description	QTY
200	TC10003887	Plate, Force Sensor	1
203	147815-000	Force Sensor Seal	1
205	147814-000	Lock Plate, Force Sensor	1
230	147799-001	Slide, Plate	1
246	TC10003157	Flex Cable Retainer	1
250	10013882	Force Sensor Assembly Kit (Includes: Force Sensor Assembly and item 474)	1
255	TC10003065	Knob, Actuator	1
265	147834-001	Flag, Shaft Interrupter	1
271	321041	Spring, Compression, 0.3 x 0.236 x 0.032	1
275	147836-002	Cam, Pull Rod	1
281	320763	Silicone Tubing (10 ft)	1
<b>NOTE:</b> A 10-foot length of tubing is enough for four PCA Modules (Figures 7B-1 and 7B-10).			
285	TC10002873	Housing, Upper	1
295	147741-000	Status Indicator Lens	1
321	302513	Retaining Ring, External, 0.188	2
325	TC10004195 ①	Barrel Clamp	1
326	321022	Spring, Compression	1
327	10010642	Sensor Assembly, Syringe Size	1
335	147810-001	Potentiometer Extension Guide	1
337	321155	Shaft Seal	1
340	147845-002	Shaft Support	1
342	147987-002	Bushing	1
345	147847-001	Flag Seal	1
350	TC10003235	Flag, Barrel Position	1
355	147848-001	Leaf, Flag Spring	1
360	TC10003211	Board Assembly, Flange Detector Sensor	1
365	TC10003525	Board Assembly, Display	1
370	147963-100	LED Backlight Assembly, Keypad	1

## ILLUSTRATED PARTS BREAKDOWN

PCA Module

**Table 7B-1. Parts List - PCA Module (Continued)**

Item	Part Number	Description	QTY
373	147851-101	Harness Assembly, Display	1
375	147792-000	IUI Bracket Strap	1
380	147739-100	Frame, Internal	1
385	TC10003125	IUI Bracket	1
390	TC10003919	Board Assembly, Logic	1
395	147816-105	Board Assembly, IUI Interface	1
396	806112	Snap Rivet, Black Nylon	1
397	320999	Cable Assembly, Dual End Connector	1
398	TC10003920	Retainer Clip	2
400	147791-002	IUI Support Bracket	1
410	142794-000	Foot, Rubber (use with item 499)	2
416	148470-000	Latch Module, Lever	1
417	148494-000	Latch Module, Lever Cover	1
418	148495-000	Latch Module, Seal	1
422	10010865	Screw, 4-40 x $\frac{3}{8}$ , BHD Torx Security (Stainless Steel)	2
450	TC10003262	Handle, Left	1
455	TC10003263	Handle, Right	1
460	321033	Screw, 6-32 x $\frac{7}{16}$ , PNH PHH (Zinc Plated Steel)	5
461	321100	O-Ring, 0.07 x 0.07, 40 Durometer	4
462	321060	Screw, M2.5 x 12, PHH CHSE HD	4
474	10013293	Screw, 2-56 x $\frac{3}{16}$ , Socket Head Cap, Nylok	4
478	148225-000	Screw, 4-20 x 1, Socket Cap Trifast	4
480	303655	Screw, 4-20 x $\frac{5}{16}$ , Trilob PNH PHH	3
486	300923	Screw, 4-40 x $\frac{5}{16}$ , PNH PHH (Zinc Plated Steel)	16
488	301708	Screw, 6-32 x $\frac{5}{16}$ , PNH PHH	3
490	320855	Screw, 6-32 x $\frac{7}{16}$ , PNH PHH (Stainless Steel)	7
491	320729	Washer, #5 (Stainless Steel)	3
492	320851	Screw, 4-40 x $\frac{5}{16}$ , PNH PHH (Stainless Steel)	5
494	320167	Washer, 0.125 x 0.312 x 0.032 (Stainless Steel)	1

**Table 7B-1. Parts List - PCA Module** (Continued)

Item	Part Number	Description	QTY
496	321035	Screw, 4-40 x $\frac{3}{4}$ , PNH PHH	6
497	10012053	Screw, 4-40 x 0.37, FLH PHH	3
498	10012051	Screw, 4-40 x $\frac{1}{4}$ , BHD Torx (Stainless Steel)	15
499	②	Silicone Grease, Dow Corning Molykote 33, or equivalent (use with item 410)	As required
645	148013-000	Label, Patent	1
646	125569	Label, Serial Number Replacement	1
800	148242-001	Bushing, Latch Module	2
801	148245-001	Rod, Latch Module	1
802	TC10003090	Bushing, Latch Module Support Bushing	1
804	148299-100	Ground Strap Harness Assembly	1
805	148298-100	Handset Harness Assembly	1
806	148373-100	Dose Request Cord Strap	1
807	809061	Eyelet Stud	1
808	320761	Washer, #4 Internal Locking	1
809	10013795	Handset Assembly	1
831	148287-000	Door, Rear	1
832	148258-000	Lockplate, Front Door	1
834	148282-000	Door, Front	1
835	TC10003128	Hinge	1
836	TC10003331	Door Strike Plate	1
837	TC10003086	Strike Lockplate	1
838	148286-000	Lockplate, Rear Door	1
844	TC10003130	Bushing, Hinge	1
860	10010964	Key Kit (Includes: 2 keys for Lock Assembly)	1
2001	10013524	Lock Assembly	1
2003	147077-100	IUI Connector Kit, Right, (Includes: Right Gasket, Right IUI Connector)	1

## ILLUSTRATED PARTS BREAKDOWN

PCA Module

**Table 7B-1. Parts List - PCA Module** (Continued)

Item	Part Number	Description	QTY
2004	147078-100	IUI Connector Kit, Left (Includes: Left Seal, Left IUI Connector)	1
2006	10013532	Latch Kit (Includes: Latch Support with washers attached, Latch Bracket, Compression Spring, and item 422)	1
		Directions for Use:	1
	10010720	PCA Module (V7)	
	10010199	Syringe Module (V7)	
		Alaris® System (supports Guardrails® Suite MX):	
	10012555	Electronic Copy	
	10012398	Printed Copy	
	148444-000	Set Compatibility Card	1

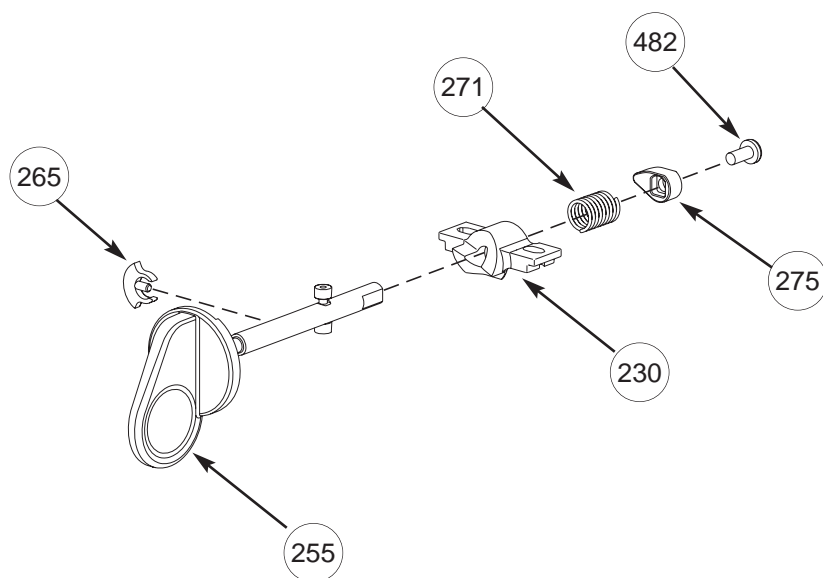
### ① **CAUTIONS**

- The Top disk Holder, Internal Frame, Shaft Support and various Syringe Barrel Clamp Assembly parts identified here are not backwards compatible with a Syringe Barrel Clamp Assembly having a Park Position “Pin” attached. Prior to ordering any of these parts, reference the “Corrective Maintenance” chapter for part identification and replacement instructions.
- Newer versions of the Park Position Collar and Barrel Clamp are not interchangeable with earlier versions. If either part requires replacement and the hex head bit,  $\frac{1}{16}$  HX,  $1\frac{15}{16}$ ” length tool was used to remove the Park Position Collar 0.062” setscrew, both parts must be replaced.

② Not sold by Cardinal Health.

**Figure 7B-1. Actuator Knob Assembly**

- 1 Actuator Knob Assembly items are available as an assembly (Table 7B-1, item 3) or separately.



## ILLUSTRATED PARTS BREAKDOWN

PCA Module

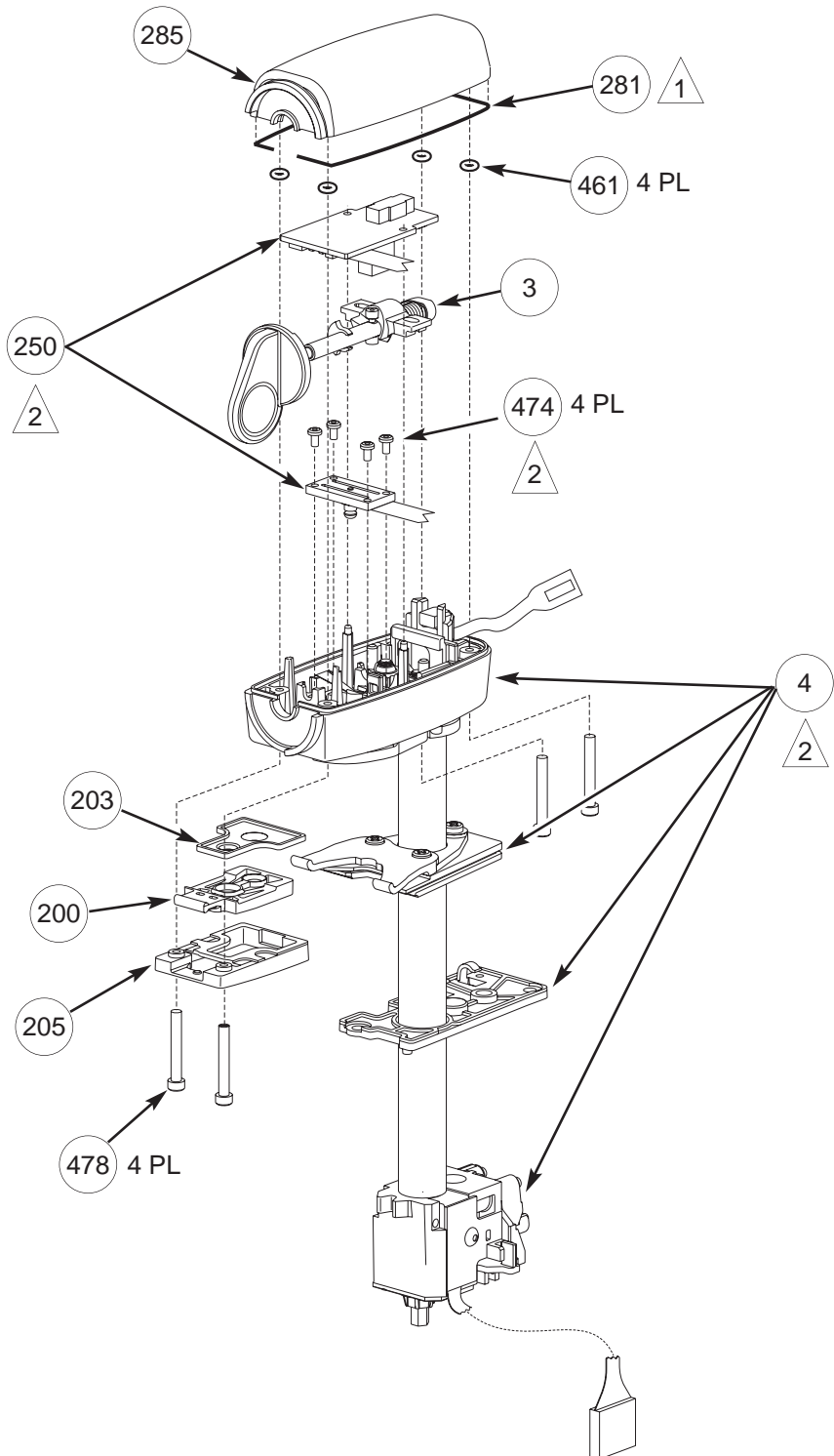
**Figure 7B-2. Housing Assembly**

### CAUTION

To avoid damaging Lower Housing (part of item 4), use Nylok screws (item 474) to install Force Sensor Assembly (item 250).

1 Install 6½" Gasket (item 281) around parameter, and into undercut feature, of Upper Housing (item 285). Gasket is not to overlap into opening for Actuator Knob Assembly (item 3).

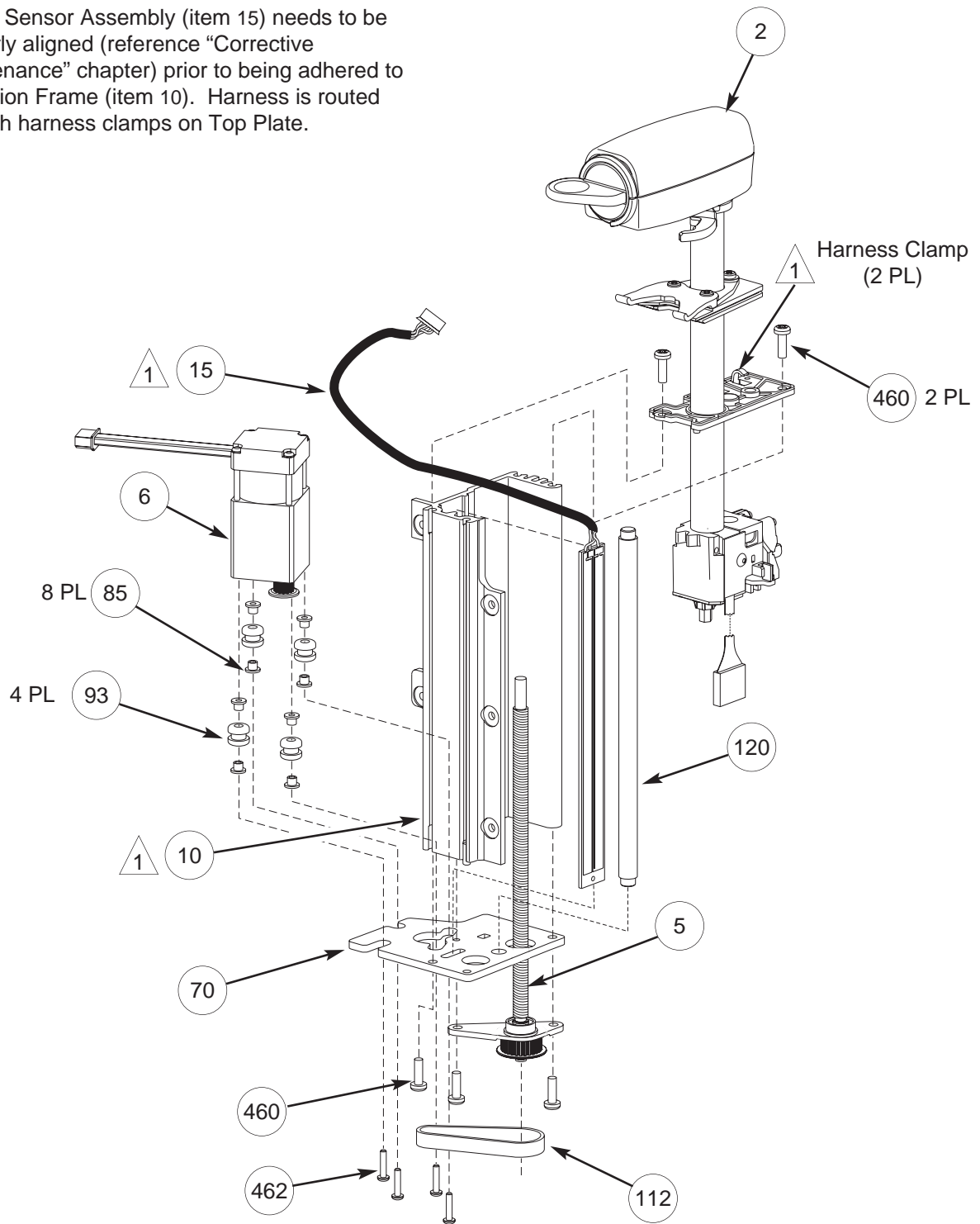
2 Nylok screws (item 474) are provided as part of Lower Housing/Carriage Assembly Kit (item 4) and Force Sensor Assembly Kit (item 250).





**Figure 7B-3. Drivetrain Assembly**

- 1 Linear Sensor Assembly (item 15) needs to be properly aligned (reference “Corrective Maintenance” chapter) prior to being adhered to Extrusion Frame (item 10). Harness is routed through harness clamps on Top Plate.



## ILLUSTRATED PARTS BREAKDOWN

PCA Module

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Figure 7B-5. Front Case Assembly - Part 2

CAUTION

Newer versions of the Park Position Collar and Barrel Clamp are not interchangeable with earlier versions. If either part requires replacement and the hex head bit, 1/16 HX, 1<sup>15</sup>/<sub>16</sub>” length tool was used to remove the Park Position Collar 0.062” setscrew, both parts must be replaced.

1 Reference “Corrective Maintenance” chapter, “Removing Syringe Barrel Clamp Assembly” section, for Shaft Seal (item 337) installation instructions.

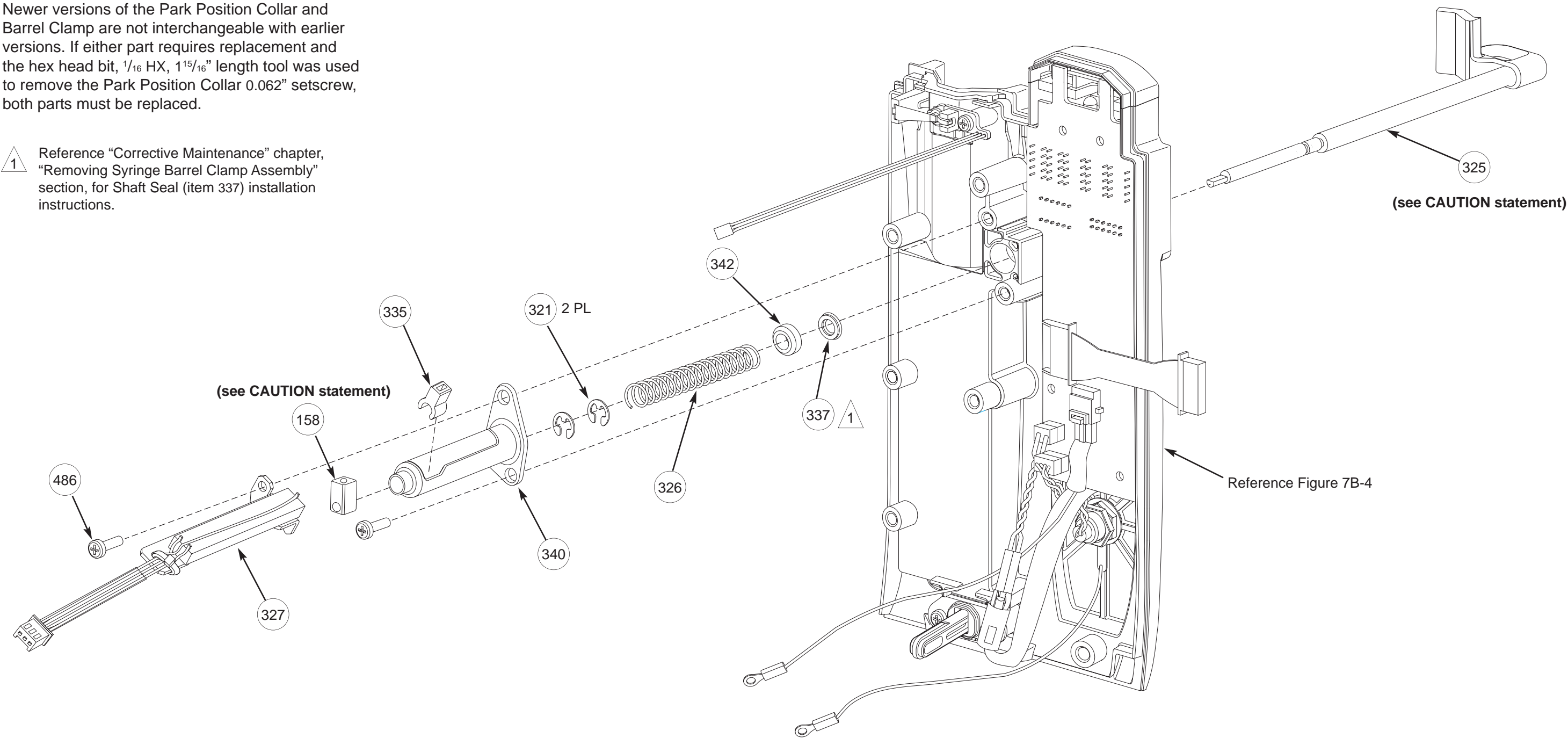
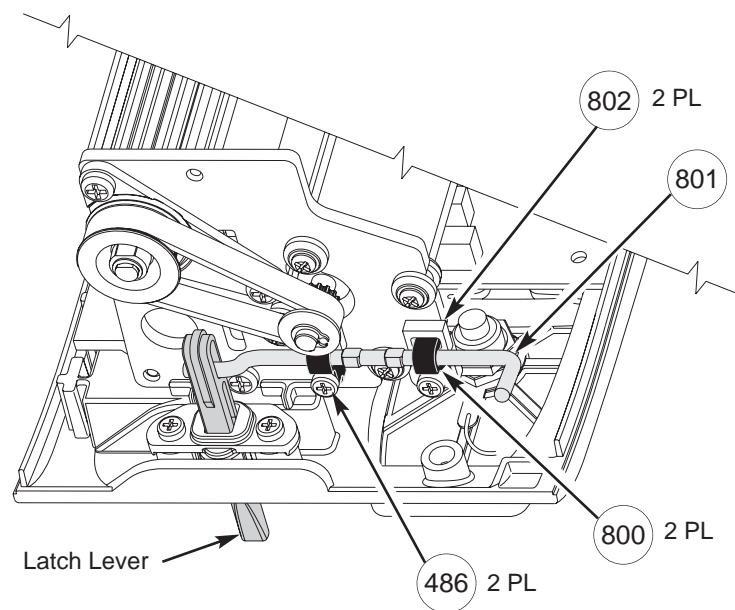


Figure 7B-6. Latch Module Assembly

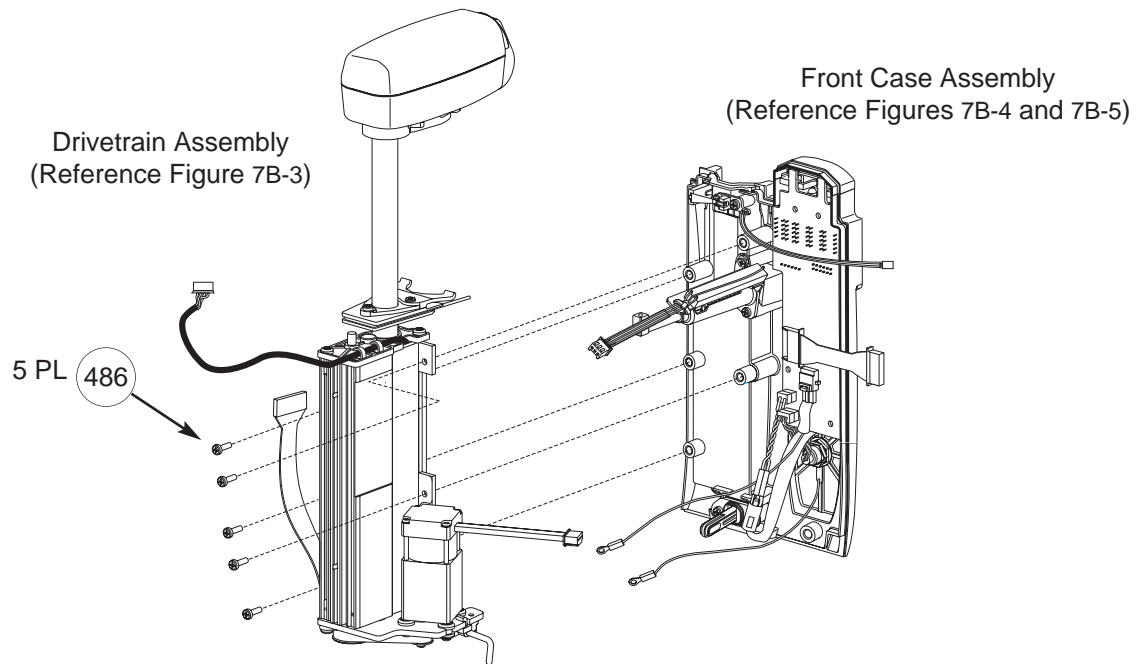


## ILLUSTRATED PARTS BREAKDOWN

PCA Module

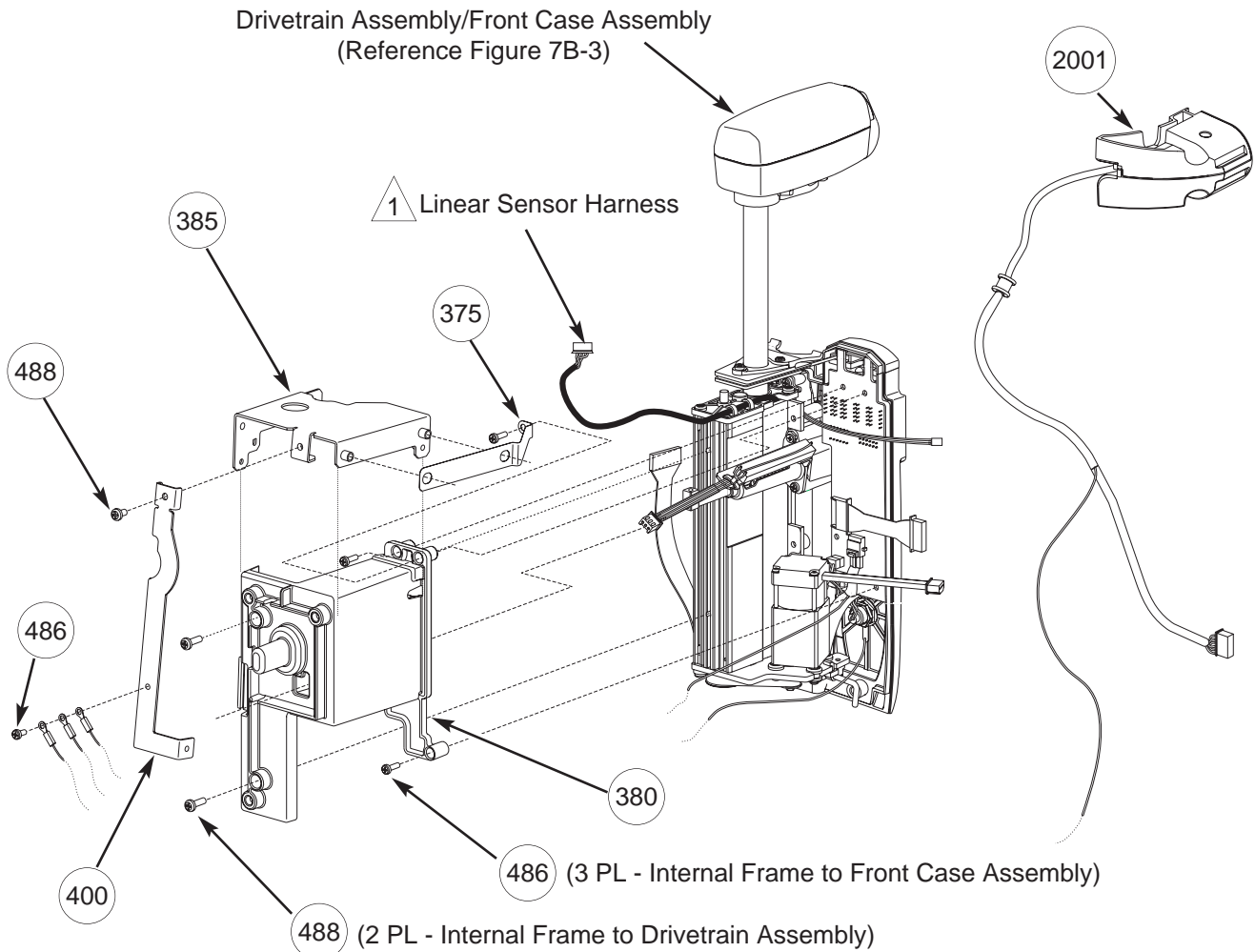
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**Figure 7B-7. Drivetrain Assembly - Front Case Assembly**



**Figure 7B-8. Internal Frame Assembly - Front Case Assembly**

- 1 Linear Sensor Harness (part of Drivetrain Assembly) is routed between IUI Bracket (item 385) and Internal Frame (item 380), and beneath IUI Support Bracket (item 400) from left to right.



## ILLUSTRATED PARTS BREAKDOWN

PCA Module

**Figure 7B-9. Logic Board and IUI Board Assemblies**

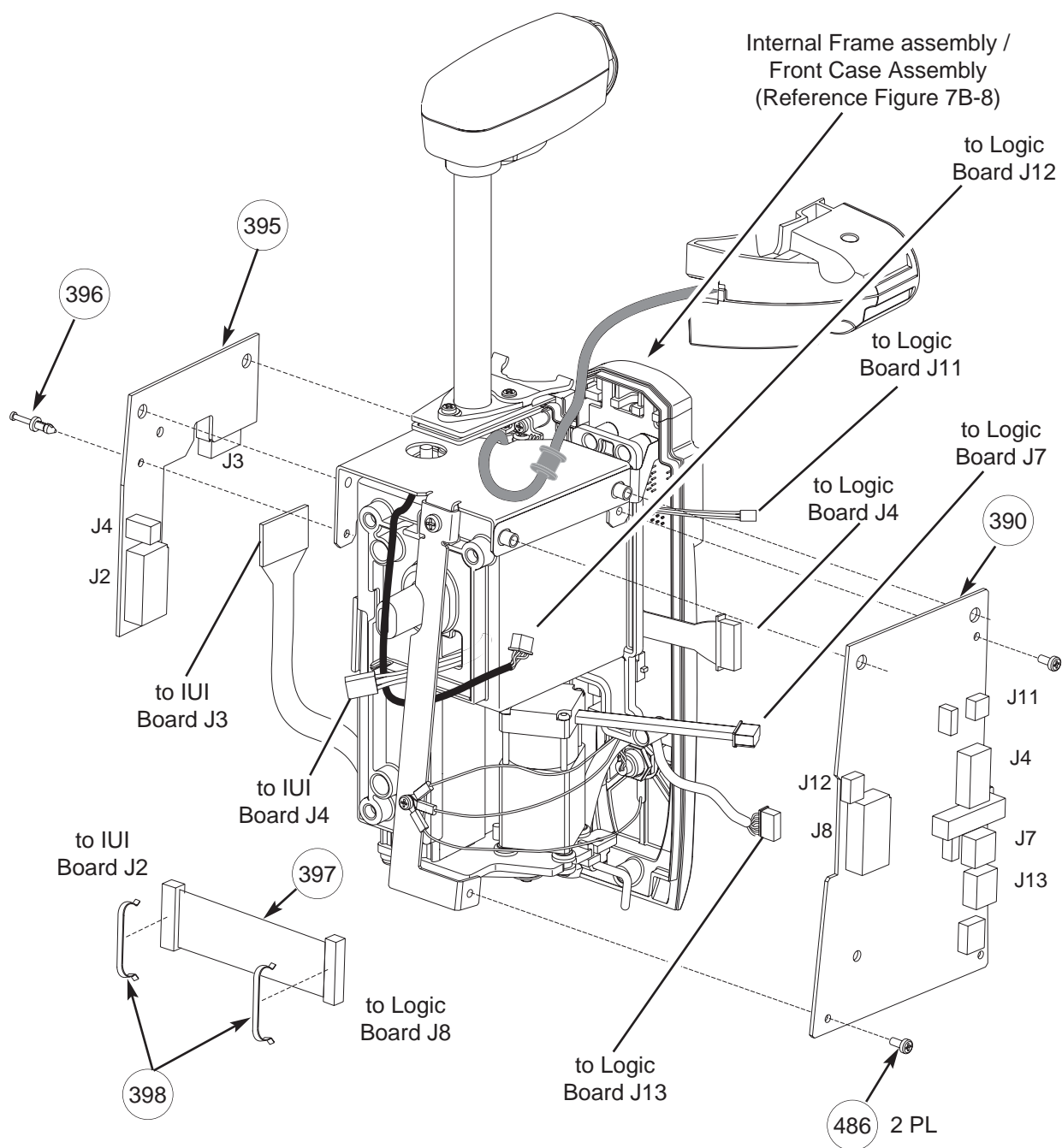
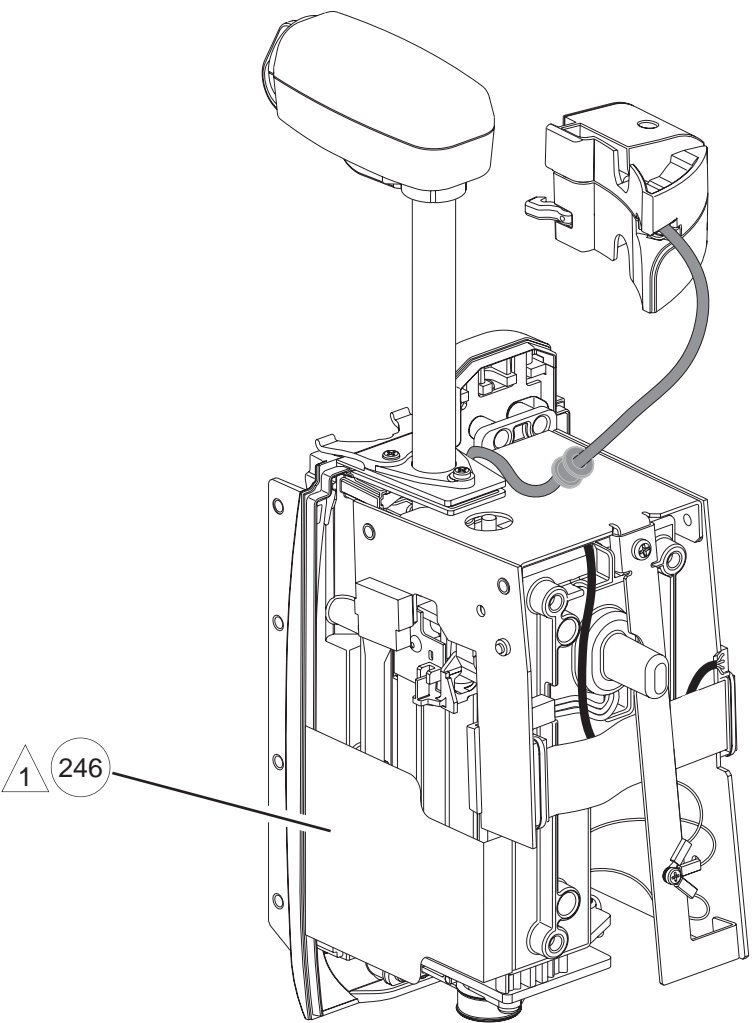
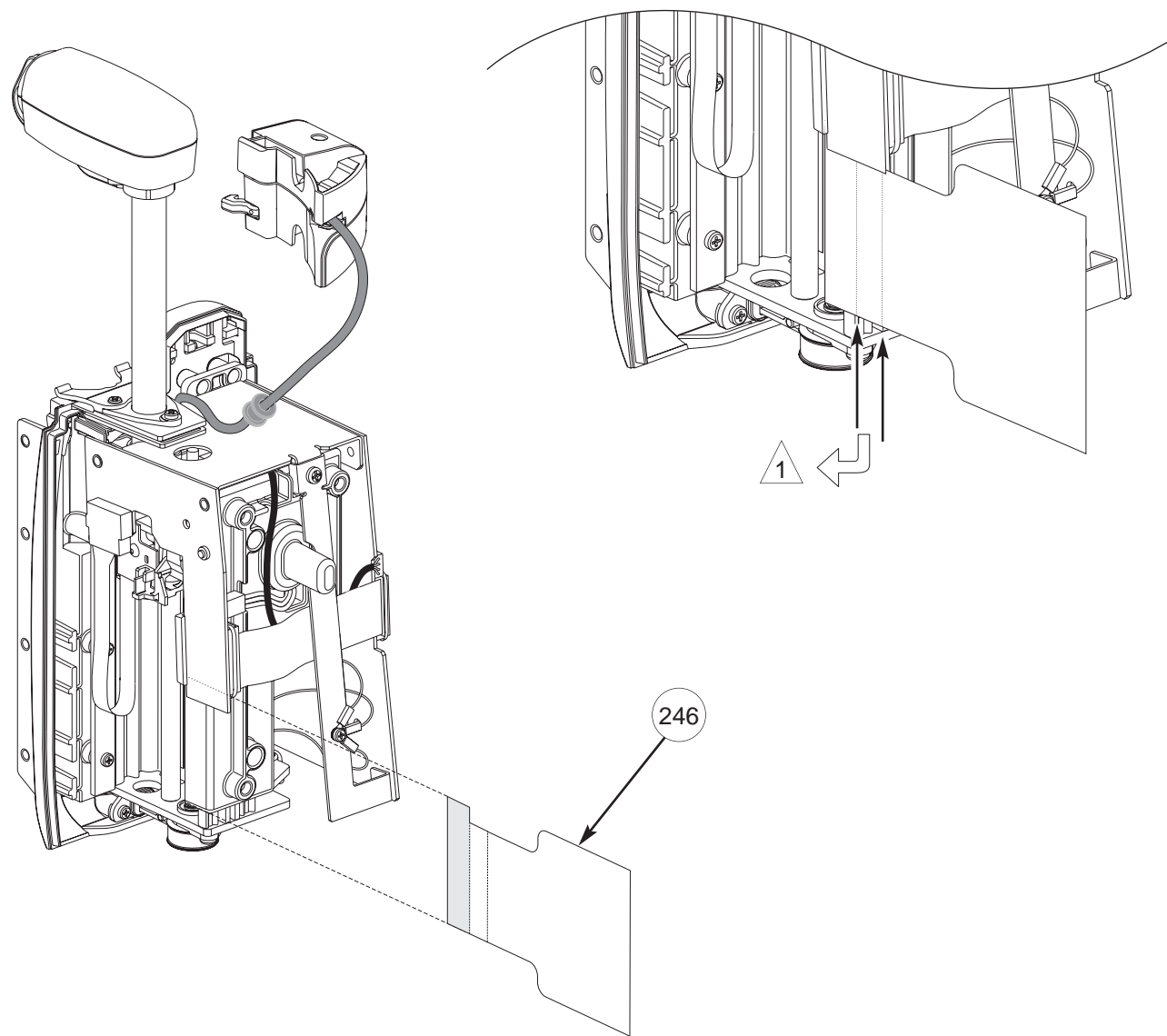




Figure 7B-10. Flex Cable Retainer Assembly

1 If necessary, bend Flex Cable Retainer on each fold line at a 90° angle, toward front of instrument. Lay retainer over Flex Cable and tuck inside edge of Front Case (reference illustration to right).



ILLUSTRATED PARTS BREAKDOWN

PCA Module

Figure 7B-11. Rear Case - Front Case Assembly

- 1

Install two Gasket (item 281) pieces, approximately 7½" and 10½", into channel on Rear Case.
- 2

Rear Case, labels (items 645 and 646), and Gasket (item 281) are provided as separate items and as part of Rear Case Assembly Kit (item 8). Reference Table 7B-1, item 8 for a list of parts included in Rear Case Assembly Kit.
- 3

Nameplate Label is available only as part of the Rear Case Assembly Kit. This label has a regulatory mark, and any level of service that requires its replacement must be performed at the factory.
- 4

Before adhering Serial Number Label (item 646):

1.

Print instrument model and serial number on label in permanent black ink.

2.

Apply clear overlay to completely cover label.

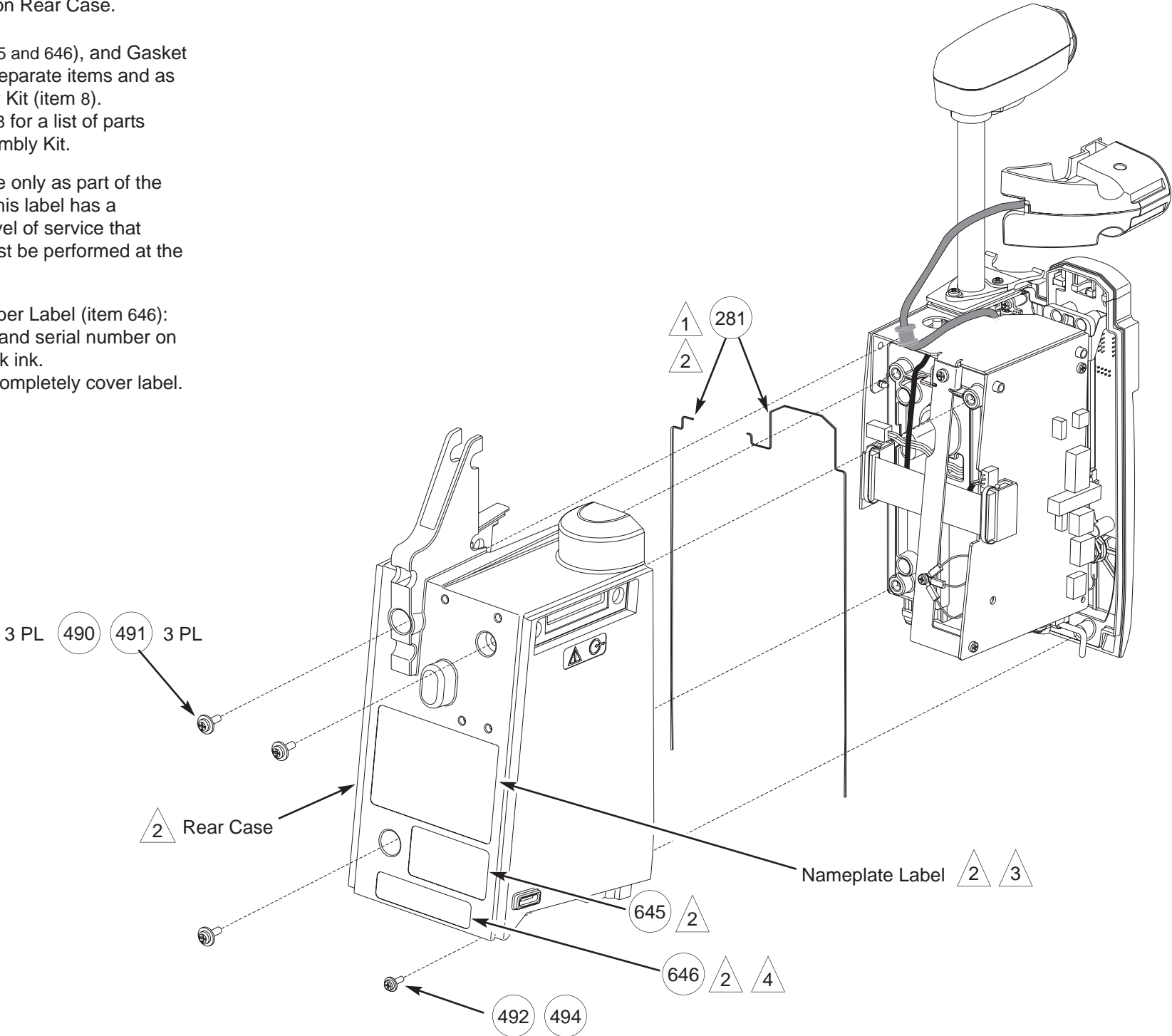
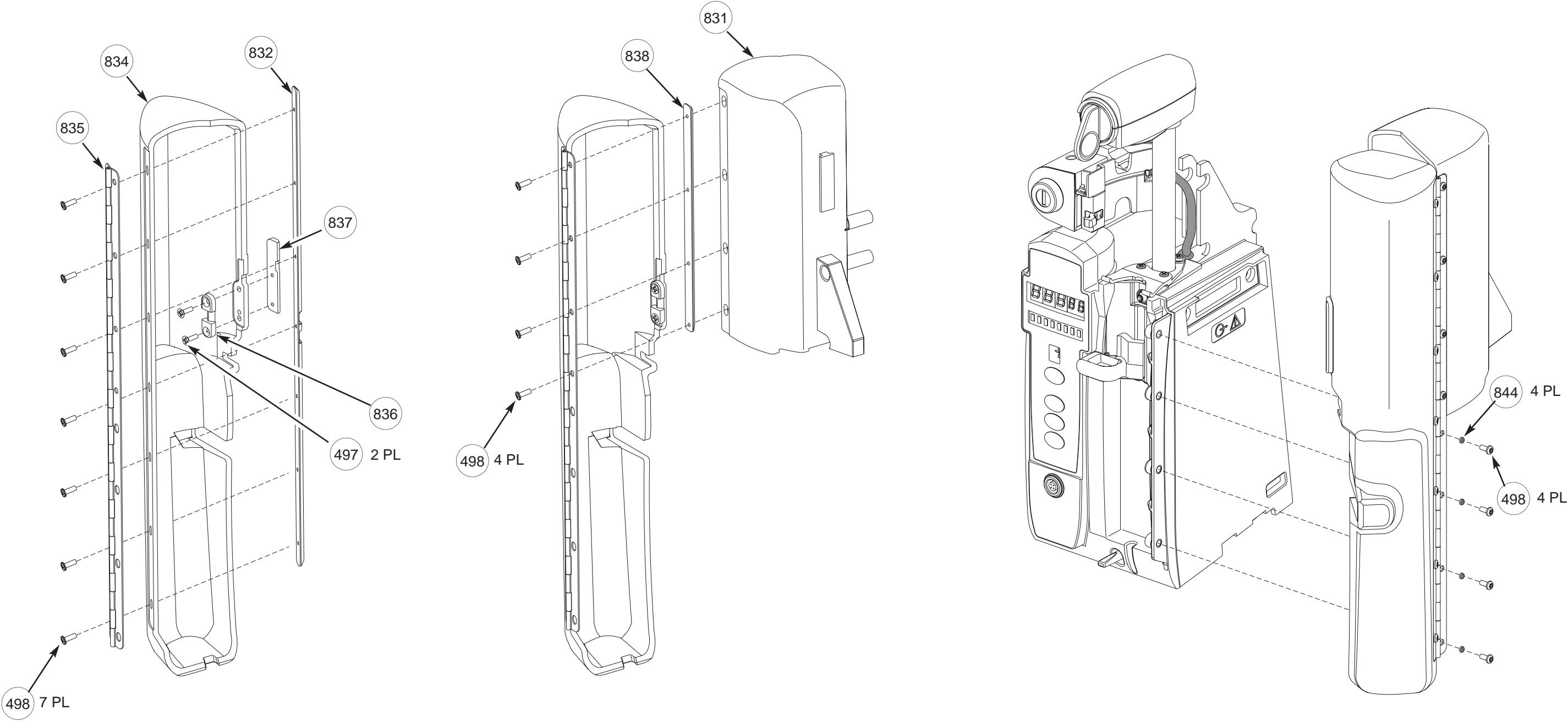
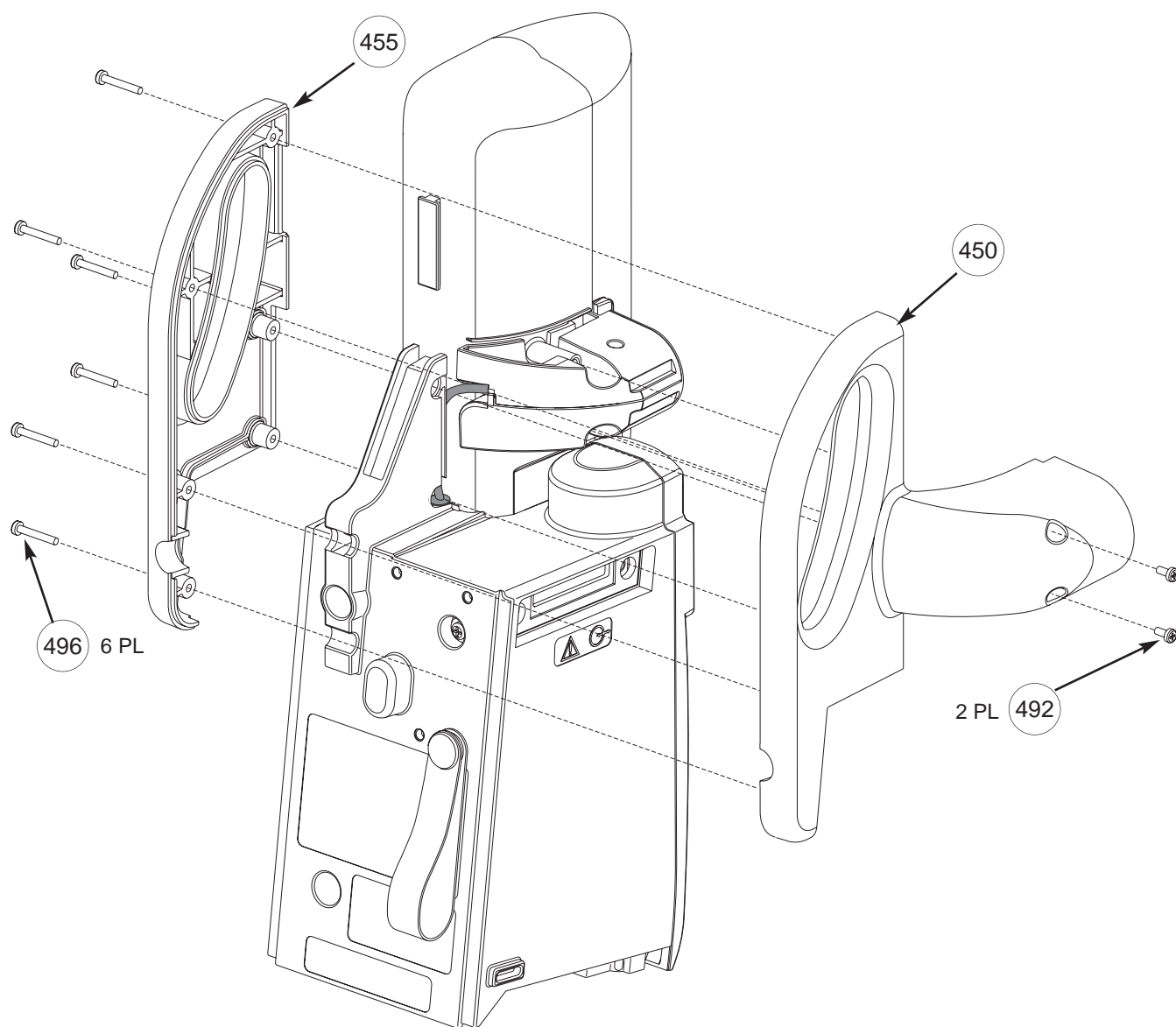


Figure 7B-12. Door Assembly



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**Figure 7B-13. Handle Assembly**



## ILLUSTRATED PARTS BREAKDOWN

PCA Module

**Figure 7B-14. Final Assembly**

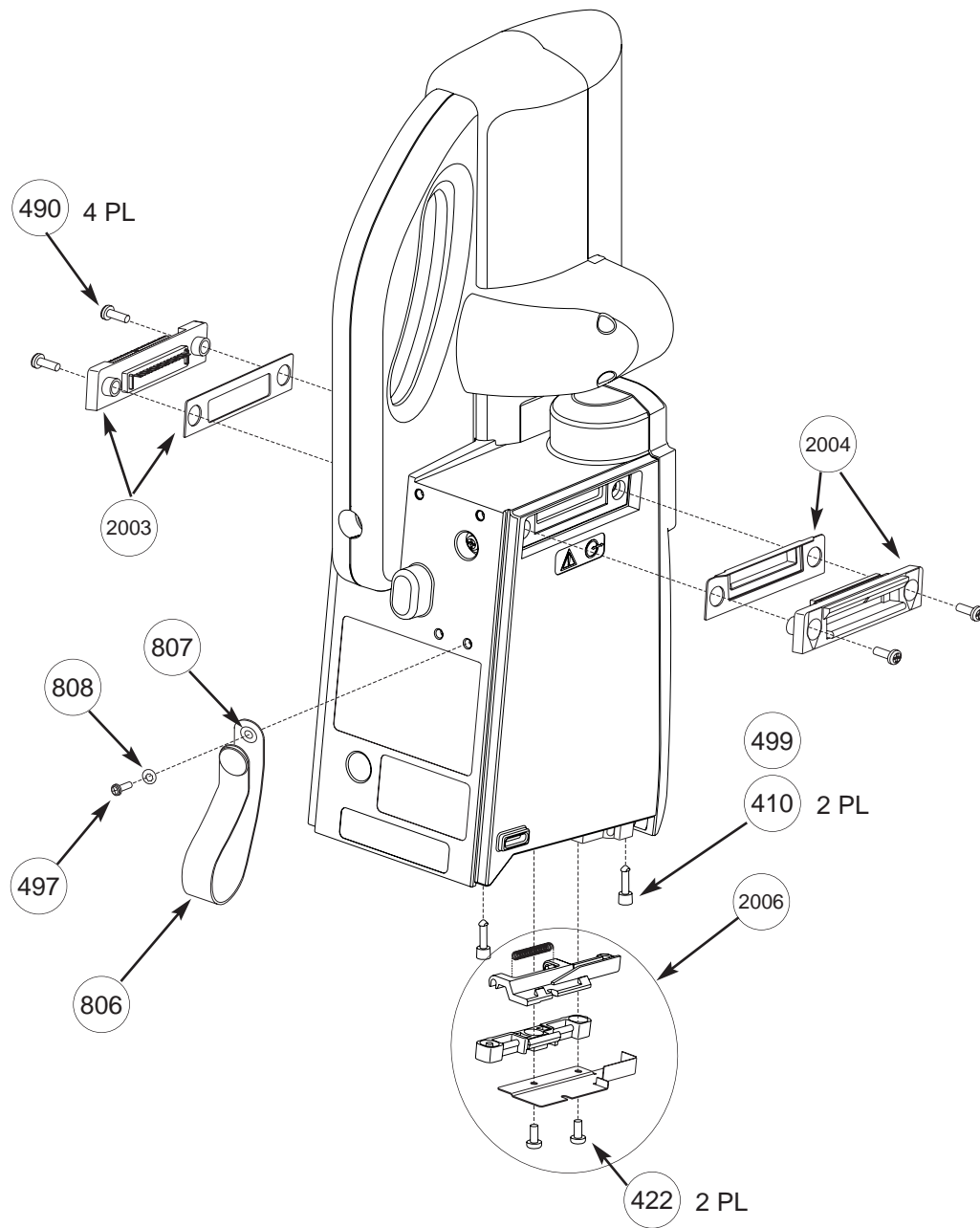
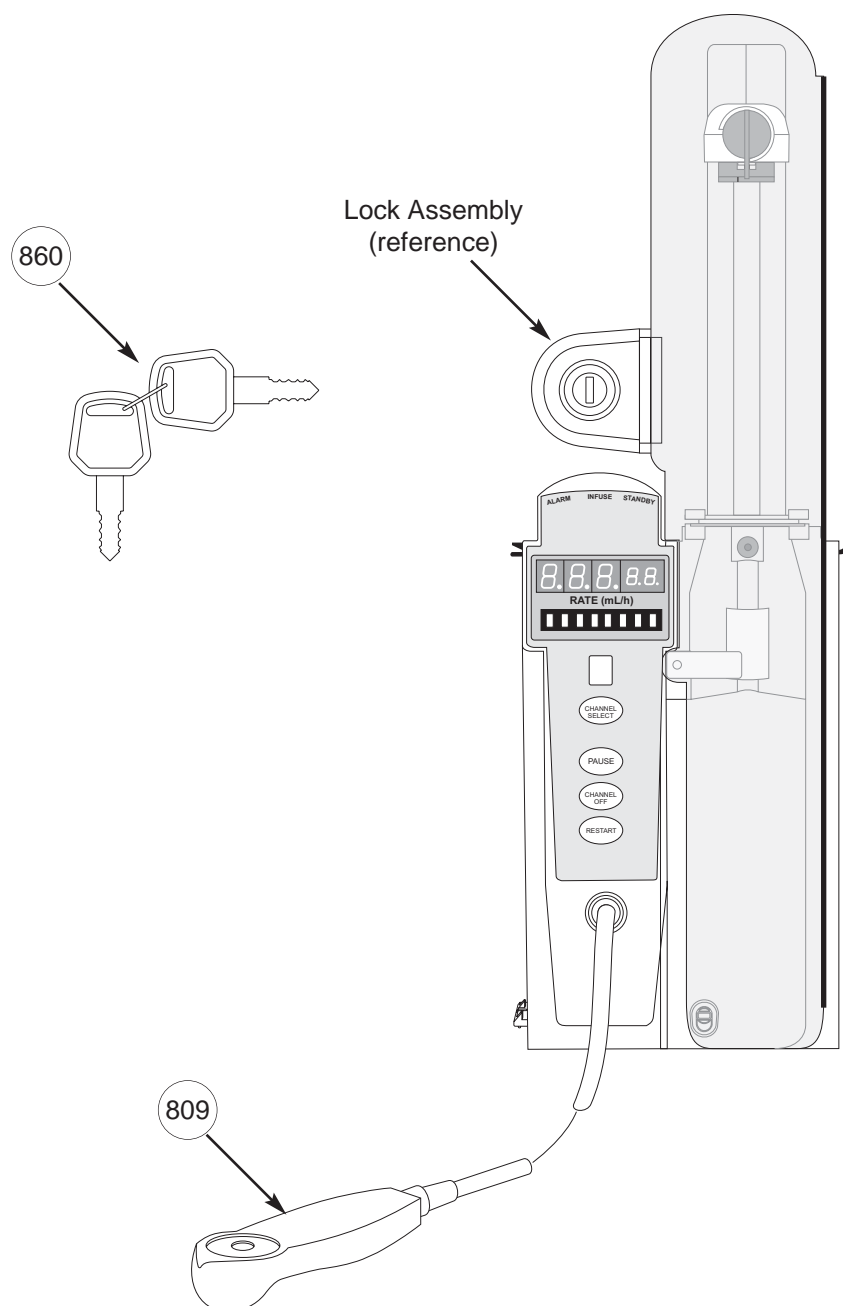


Figure 7B-15. Key Kit and Handset

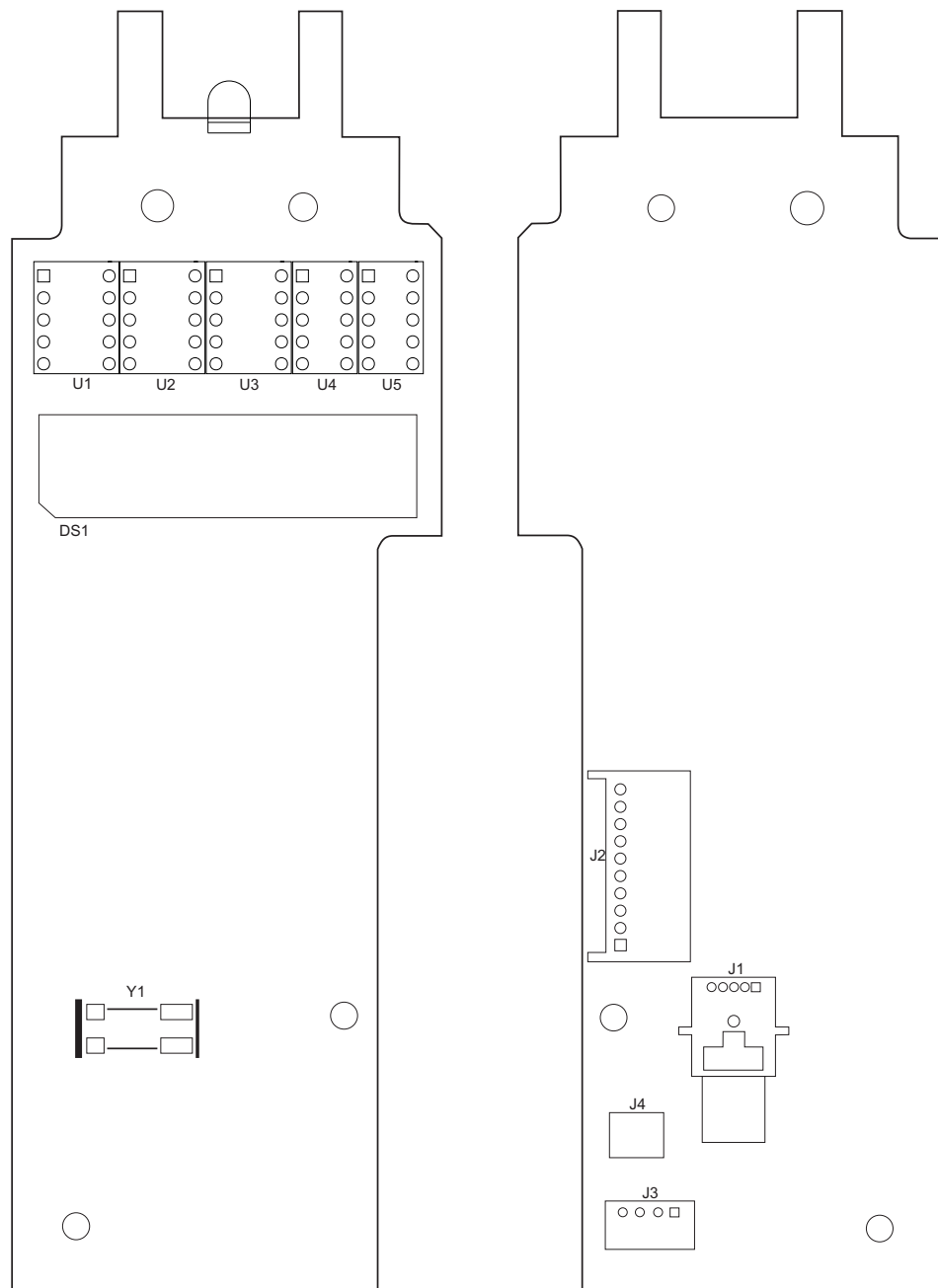


## ILLUSTRATED PARTS BREAKDOWN

PCA Module

**Figure 7B-16. Display Board Assembly**

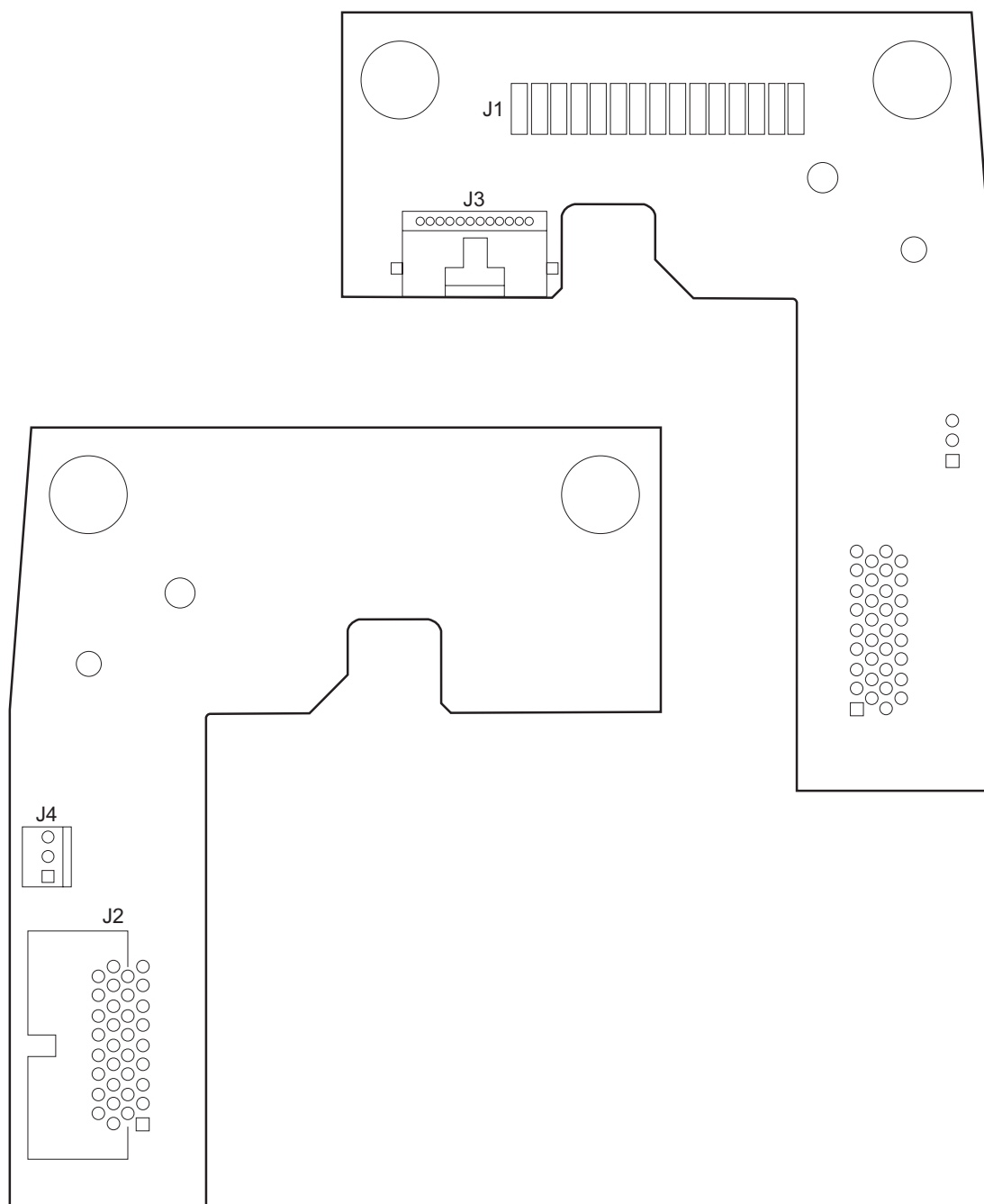
**NOTE:** This illustration is for board identification purposes only and does not represent the board's component layout.





**Figure 7B-17. IUI Interface Board Assembly**

**NOTE:** This illustration is for board identification purposes only and does not represent the board's component layout.

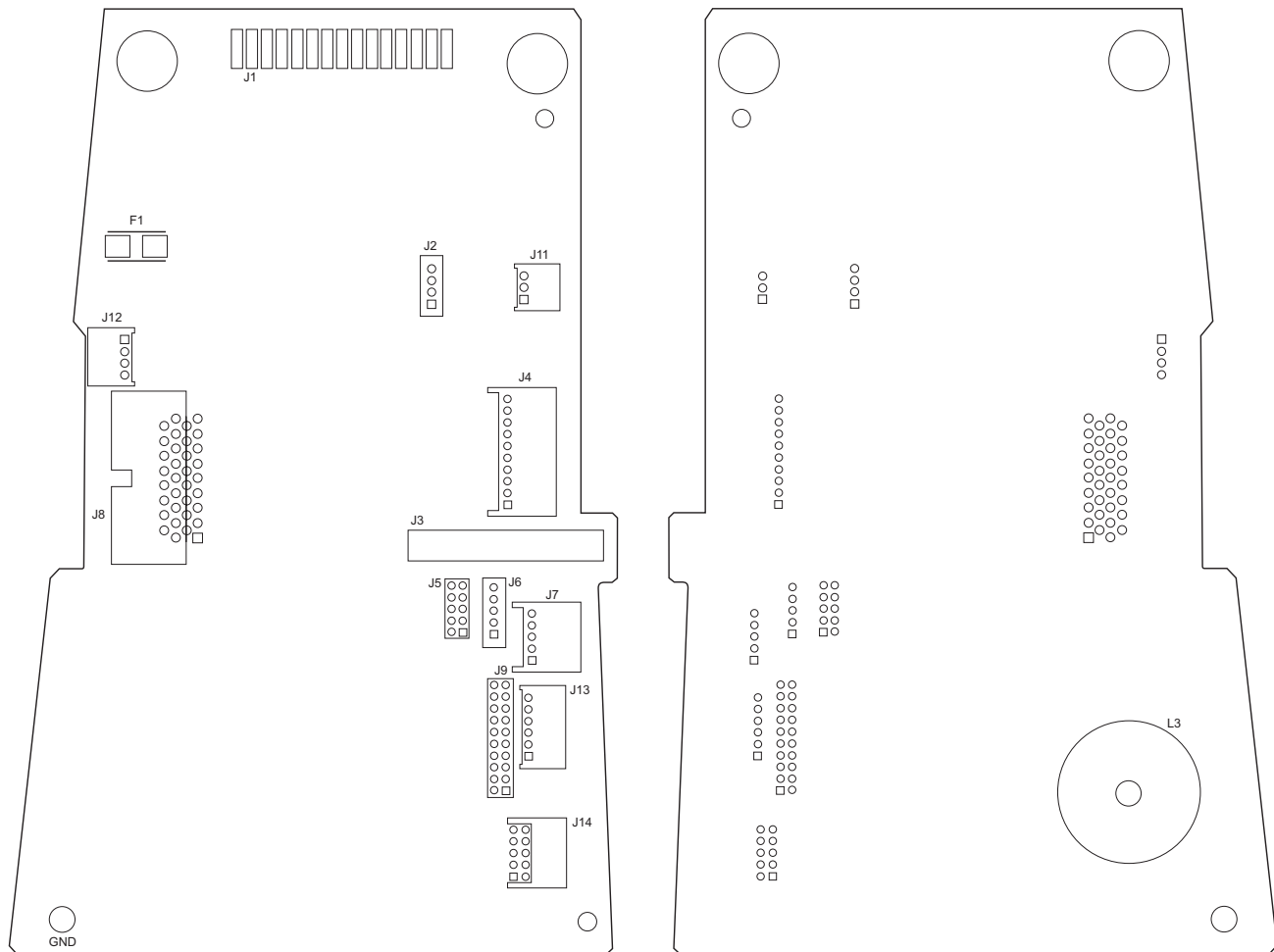


## ILLUSTRATED PARTS BREAKDOWN

PCA Module

**Figure 7B-18. Logic Board Assembly**

**NOTE:** This illustration is for board identification purposes only and does not represent the board's component layout.







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